William Weiss Associates
Fairfax Virginia 22031

INSTRUCTION MANUAL
FOR
TYPE 521A RECEIVER

WATKINS JOHNSON

INSTRUCTION MANUAL
FOR
TYPE 521A RECEIVER

WATKINS-JOHNSON COMPANY
CEI DIVISON
6006 EXECUTIVE BOULEVARD
ROCKVILLE, MARYLAND 20852

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WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised in working with the equipment with any of the protective covers removed.

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Table 1-1. Type 521A Receiver, Specifications

Types of Reception	AM, FM, and CW
Frequency Range	20 to 70 MHz in one band
Input Impedance	50 ohms, nominal
Noise Figure	6dB, maximum
Image Rejection	65 dB, minimum
IF Rejection	90 dB, minimum
IF Bandwidths	4 kHz, 10 kHz, 50 kHz
IF Center Frequenies	10 MHz and 455 kHz
Oscillator to Antenna Conduction	15 μV, maximum
Local Oscillator Output Level	50 mV minimum, across 50 ohm load
Sensitivity:	
4-kHz Bandwidth	AM: 0.35-μV input modulated 50% at 400 Hz produces 10 dB (s plus n)/n, minimum
10-kHz Bandwidth	AM: 0.56-μV input modulated 50% at 400 Hz produces 10 dB (s plus n)/n, minimum. FM: 1.1-μV input modulated at 400-Hz rate with 3.5-kHz deviation produces 21.0 dB (s plus n)/n, minimum
50-kHz Bandwidth	AM: 1.26-μV input modulated 50% at 400 Hz produces 10 dB (s plus n)/n minimum. FM: 2.2-μV input modulated at 400-Hz rate with 17 kHz deviation produces 21.0 dB (s plus n)/n, minimum
Output Stability:	
4-kHz Bandwidth	AM: Output varies less than 2.5 dB for input level range of 0.5 μV to 100 mV.
10-kHz Bandwidth	AM: Output varies less than 2.0 dB for input level range of 0.75 μV to 100 mV.
50-kHz Bandwidth	AM: Output varies less than 2.0 dB for input level range of 1.75 μV to 100 mV. FM: Output varies less than 1.0 dB for input level range of 1.0 μV to 100 mV.
Video Amplifier:	
Output Level	5.0 Vrms across 10k ohm, unbalanced load.
Frequency Response	20 Hz to 20 kHz at 3 dB points
Audio Amplifier:	
Output Level	100 mW, minimum, across 600-ohm load
Frequency Response:	
4-kHz Bandwidth	100 Hz to 2 kHz at 3 dB points
10-kHz Bandwidth	100 Hz to 5 kHz at 3 dB points
50-kHz Bandwidth	100 Hz to 25 kHz at 3 dB points

Table 1-1. Type 521A Receiver, Specifications (Cont'd)

Beat Frequency Oscillator:	
Center Frequency	455 kHz
Range	±5 kHz, nominal
IF (Predetection) Output:	
Frequency	455 kHz
Level	10 mV, minimum, across 50-ohm load, for input signal levels above AGC threshold.
Carrier Operated Relay:	
Sensitivity	Less than 1 μV
Range	Adjustable to operate over an input level range of 1 μV to greater than 500 μV.
Release Time	Slow: 6 seconds ±20%; Fast: less than 0.5 second
Output	SPDT Contacts
Dial Accuracy	±1%
Signal Monitor Section:	
Input Impedance	50 ohms, nominal
Input Center Frequency	10 MHz
Range of Center Frequency Control	±50 kHz
Resolution	2.5 kHz
Sweep Width	0-300 kHz; continuously adjustable
IF Frequencies	2 MHz, 205 kHz
Oscillator Frequencies:	
Sweep Oscillator	12 MHz, ±1/2 sweep width
Second Oscillator	2.205 MHz, crystal controlled
Image Rejection	60 dB, minimum
Sensitivity	10 μV input at 10 MHz produces at least a 1-inch vertical deflection on CRT
Sweep Rate	22.5 Hz, ±5 Hz
Gain Control Range	60 dB, minimum
Marker Frequency	10 MHz
Size	19-inches wide, 3.5-inches high 18.8 inches deep (including handles)
Weight	18 lbs., approximately

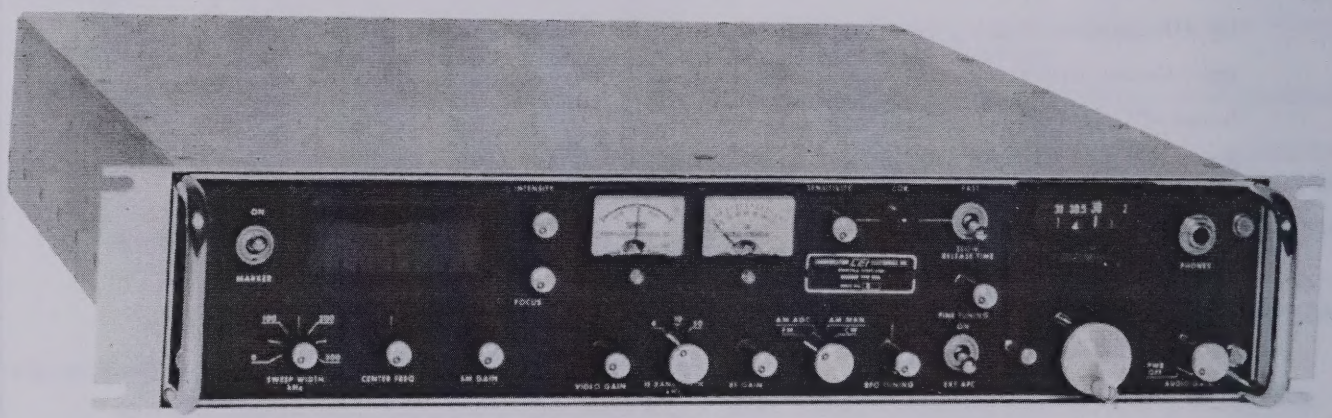


Figure 1-1. Type 521A Receiver, Front View

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The CEI Type 521A Receiver is designed for AM, FM, and CW reception in the 20 to 70 MHz frequency range. This double-conversion superheterodyne receiver covers the range in one band. IF bandwidths of 4- 10- and 50-kHz may be selected by means of a front-panel switch. A beat frequency oscillator (BFO), located on the IF strip, is activated when the CW mode of operation is selected. The CW-audio beat note may be varied by means of a front-panel control. The 521A receiver contains a built-in signal monitor that provides a visual display of signals at, or near, the frequency to which the unit is tuned. This display can be used to determine such things as the frequency, amplitude, and type of signal being received. The sweep width of the signal monitor is continuously variable from 0 to 300 kHz by means of a potentiometer located on the front panel. The resolution of the signal monitor is such that two signals 2.5 kHz apart will be displayed with at least a 6-dB valley between the peaks (using a sweep width of 10-kHz or greater).

1.1.2 The 521A receiver has been designed so that it may be operated with an optional, external frequency counter to provide a five-digit Nixie display of the frequency to which the receiver is tuned. Thus, the frequency can be read within ±1 kHz over the entire tuning range. The external counter contains a digital automatic frequency control (DAFC) circuit which counteracts drift in the receiver's local oscillator. When oscillator drift occurs, a correction voltage is produced in the DAFC circuit, which is subsequently fed to the receiver through the EXT AFC switch on the front panel. Placing this switch in the ON position applies the correction voltage to the local oscillator circuit, pulling the oscillator back on frequency.

1.1.3 Signal outputs from the 521A receiver include a predetection IF output, a local oscillator output, a video output, an audio output and a COR (carrier operated relay) output. A jack on the front panel provides a means of monitoring the audio output with headphones. Pertinent specifications for the receiver are listed in Table 1-1; the transistor complement is listed in Table 1-2.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 A front view of the 521A receiver is shown in Figure 1-1. The following controls and indicators associated with the receiving function of the unit are mounted on the front panel: IF BANDWIDTH kHz, function, EXT AFC, and COR RELEASE TIME switches, AUDIO GAIN (also turns power on and off), VIDEO GAIN, RF GAIN, BFO TUNING, COR SENSITIVITY and FINE TUNING controls, the main tuning control and associated tape dial, SIGNAL STRENGTH and TUNING meters, and the PHONES jack. The controls and indicators appearing on the front panel that are associated with the signal monitor function are: SWEEP WIDTH kHz, CENTER FREQ, SM GAIN, FOCUS and INTENSITY controls, the MARKER switch, and the CRT screen.

1.2.2 The rear apron of the 521A receiver, shown in Figure 5-2, mounts RF INPUT jack J1, LO OUTPUT jack J2, AFC INPUT jack J3, IF OUTPUT jack J4, and VIDEO OUTPUT jack J5, all of which are BNC-type connectors. The rear apron also mounts terminal board TB1 which supplies the audio, AGC monitor, and COR outputs, line fuses F1 and F2, input power selector switch S6, and the permanently connected power cord.

1.2.3 The main chassis, front panel, and top and bottom dust covers are constructed of aluminum. The front panel is finished with grey enamel and is overlaid with a black-anodized etched bezel. The main chassis of the receiver contains eleven subassemblies. Three of these, the 20-70-MHz RF tuner, the triple-bandwidth IF amplifier, and the signal monitor are constructed on silver-plated brass chassis which have been gold-flashed to prevent tarnishing. Seven of the remaining eight subassemblies, the audio, video, AGC, and COR amplifiers, and the -12V, +18V and +24V power supply regulators are constructed on etched-circuit cards that plug into receptacles on the main chassis. A fourth brass chassis contains the FM limiter/discriminator board. The signal monitor contains three additional etched-circuit boards. Two are mounted inside the brass chassis and the third is mounted on the rear of the assembly. The 521A receiver is designed for mounting in a standard 19-inch rack. Over-all dimensions are 19-inches wide, 3.5 inches high, and 18.8 inches deep (including handles).

Table 1-2. Type 521A Receiver, Transistor Complement

Ref Desig.	Type	Function
	Type 71187 20-70 MHz RF Tuner (A1)	
Q1	TA2644	RF Amplifier
A2Q1	3N128	Mixer
A3Q1	2N3478	Local Oscillator
A3Q2	2N3478	Buffer
	Type 79331 FM Limiter/Discriminator (A2)	
A1Q1	2N4074	Limiter
A1Q2	2N4074	Limiter
A1Q3	2N4074	Limiter
A1Q4	2N3478	Limiter
A1Q5	2N3251	Emitter Follower
A1Q6	2N4074	Emitter Follower
	Type 72186 4/10/50 kHz IF Amplifier (A3)	
Q1	TA2644	IF Amplifier
Q2	3N128	Mixer
Q3	2N3478	Oscillator
Q4	2N3478	Buffer/Amplifier
Q5	2N4074	IF Amplifier
Q6	2N3478	50-kHz IF Amplifier
Q7	2N3478	10-kHz IF Amplifier
Q8	2N3478	4-kHz IF Amplifier
Q9	2N3933	Emitter Follower
Q10	2N3933	Emitter Follower
Q11	2N3933	Emitter Follower
Q12	TA2644	IF Amplifier
Q13	2N3251	DC Amplifier
Q14	2N3933	DC Amplifier
Q15	2N4074	Emitter Follower
Q16	2N3933	BFO
Q17	2N3933	Buffer Amplifier
	Type 79332 Signal Monitor (A4)	
A1A1Q1	2N3478	10-MHz Shaping Amplifier
A1A1Q2	2N3478	10-MHz Shaping Amplifier
A1A1Q3	3N128	Mixer
A1A1Q4	2N3478	Sweep Oscillator
A1A2Q1	2N3478	2-MHz IF Amplifier
A1A2Q2	2N3478	Mixer
A1A2Q3	2N3478	205-kHz IF Amplifier
A1A2Q4	2N3933	205-kHz IF Amplifier
A1A2Q5	2N706	2.205-MHz Oscillator
A1A3Q1	2N706	10-MHz Marker Oscillator
A2Q1	2N2646	Sawtooth Generator
A2Q2	2N3251	Constant Current Generator
A2Q3	2N929	Emitter Follower
A2Q4	NOT USED	
A2Q5	2N929	Emitter Follower

Table 1-2. Type 521A Receiver, Transistor Complement (Cont'd)

Ref Desig.	Type	Function
A2Q6	NOT USED	
A2Q7	NOT USED	
A2Q8	2N3440	Horizontal Output Amplifier
A2Q9	2N2270	Emitter Follower
A2Q10	2N2270	Emitter Follower
A2Q11	2N929	DC Amplifier
A2Q12	2N3251	DC Amplifier
A2Q13	2N3440	Horizontal Output Amplifier
V1	3XP1	Cathode Ray Tube
	Type 76118A -12V Regulated Power Supply Board (A5)	
Q1	2N3055	Series Regulator
Q2	2N4037	Regulator Control
Q3	2N4037	Differential Amplifier
Q4	2N4037	Differential Amplifier
	Type 76121A +24V Regulated Power Supply Board (A6)	
Q1	2N3055	Series Regulator
Q2	2N4074	Regulator Control
Q3	2N4074	Differential Amplifier
Q4	2N4074	Differential Amplifier
	Type 76124 +18V Regulated Power Supply Board (A7)	
Q1	2N3055	Series Regulator
Q2	2N4074	Regulator Control
Q3	2N4074	Differential Amplifier
Q4	2N4074	Differential Amplifier
	Type 7338 Video Amplifier (A8)	
Q1	2N4074	Video Amplifier
Q2	2N3251	Video Amplifier
Q3	2N2270	Emitter Follower
Q4	2N4037	Emitter Follower
	Type 7424 Audio Amplifier (A9)	
Q1	2N4074	Audio Amplifier
Q2	2N3251	Audio Amplifier
Q3	2N2270	Emitter Follower
Q4	2N4037	Emitter Follower
	Type 7509 Carrier Operated Relay (A10)	
Q1	2N4074	COR Amplifier
Q2	2N4074	DC Amplifier
Q3	2N4074	DC Amplifier

Table 1-2. Type 521A Receiver, Transistor Complement (Cont'd)

Ref. Desig.	Type	Function
	Type 79316 AGC Amplifier (A11)	
Q1	2N4074	AGC Pre-amp
Q2	2N4074	AGC Pre-amp
Q3	2N3251	Emitter Follower
Q4	2N4074	Emitter Follower
Q5	2N4074	DC Amplifier
Q6	2N3251	IF AGC Amplifier
Q7	2N4074	DC Amplifier
Q8	2N3251	Differential Amplifier
Q9	2N3251	Differential Amplifier
Q10	2N4074	RF AGC Amplifier

Figure 2-1

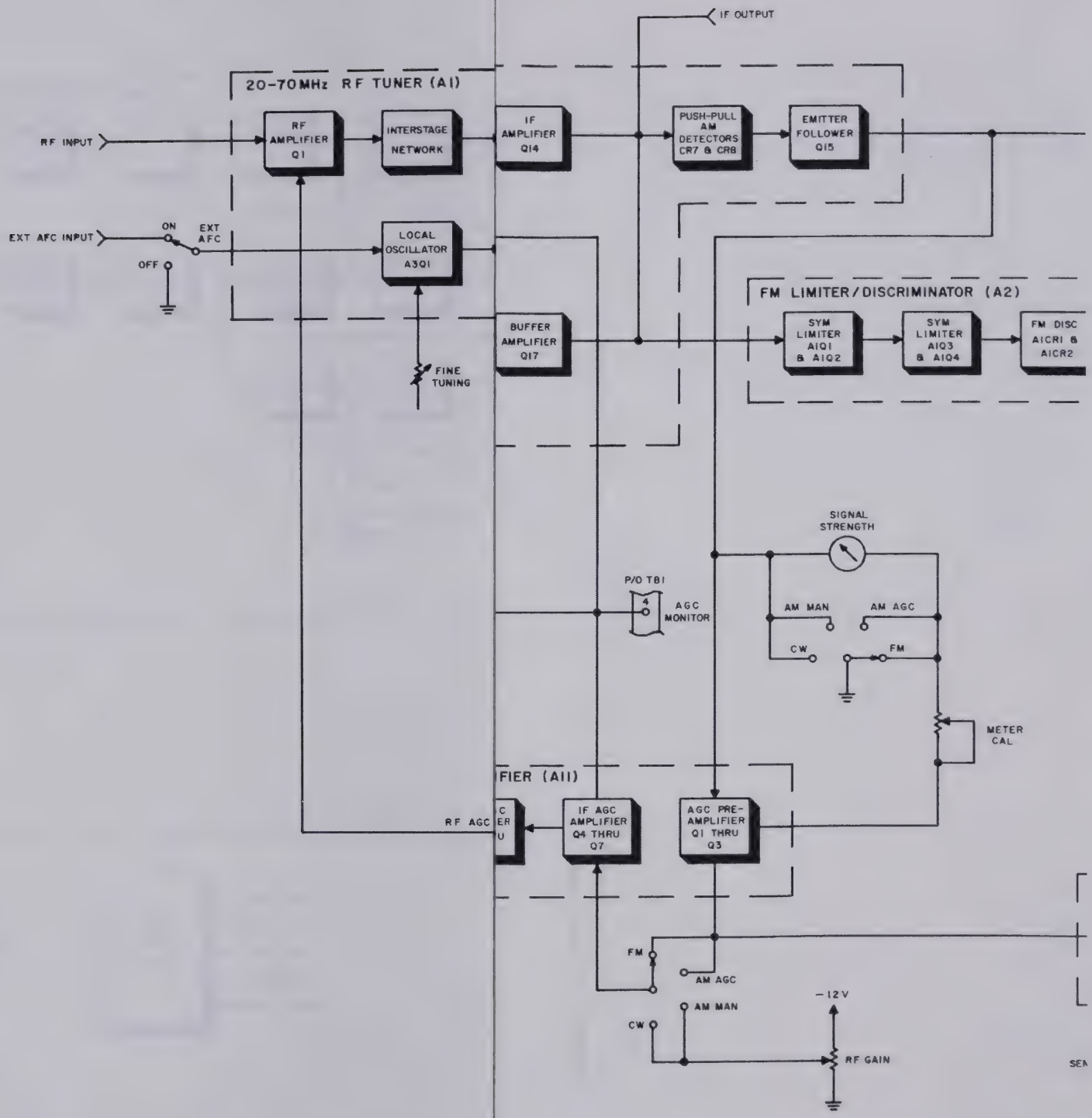


Figure 2-1. Type 521A Receiver, Functional Block Di

Table 1-2. Type 521A Receiver, Transistor Complement (Cont'd)

Ref. Desig.	Type	Function
	Type 79316 AGC Amplifier (A11)	
Q1	2N4074	AGC Pre-amp
Q2	2N4074	AGC Pre-amp
Q3	2N3251	Emitter Follower
Q4	2N4074	Emitter Follower
Q5	2N4074	DC Amplifier
Q6	2N3251	IF AGC Amplifier
Q7	2N4074	DC Amplifier
Q8	2N3251	Differential Amplifier
Q9	2N3251	Differential Amplifier
Q10	2N4074	RF AGC Amplifier

Figure 2-1

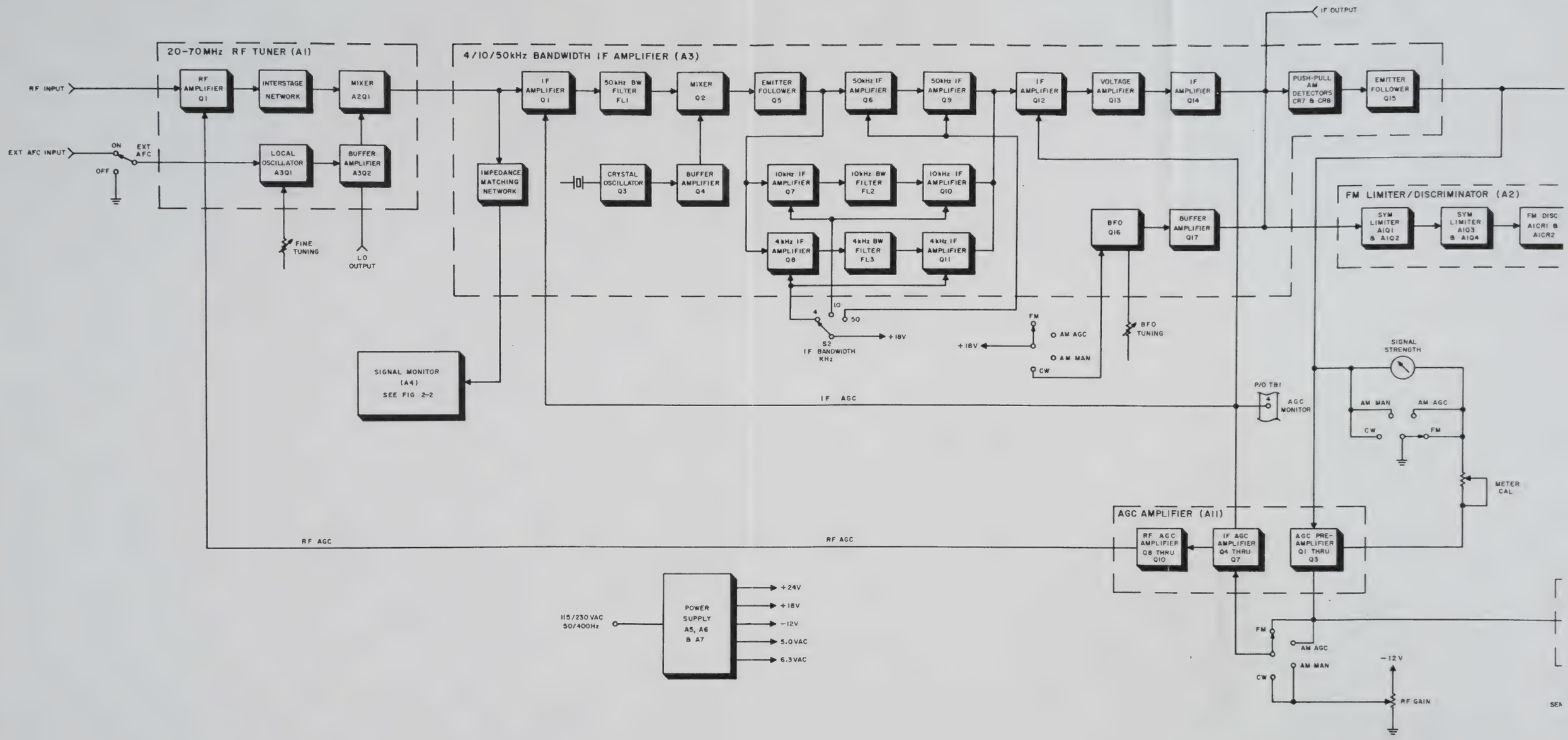


Figure 2-1. Type 521A Receiver, Functional Block Diagram

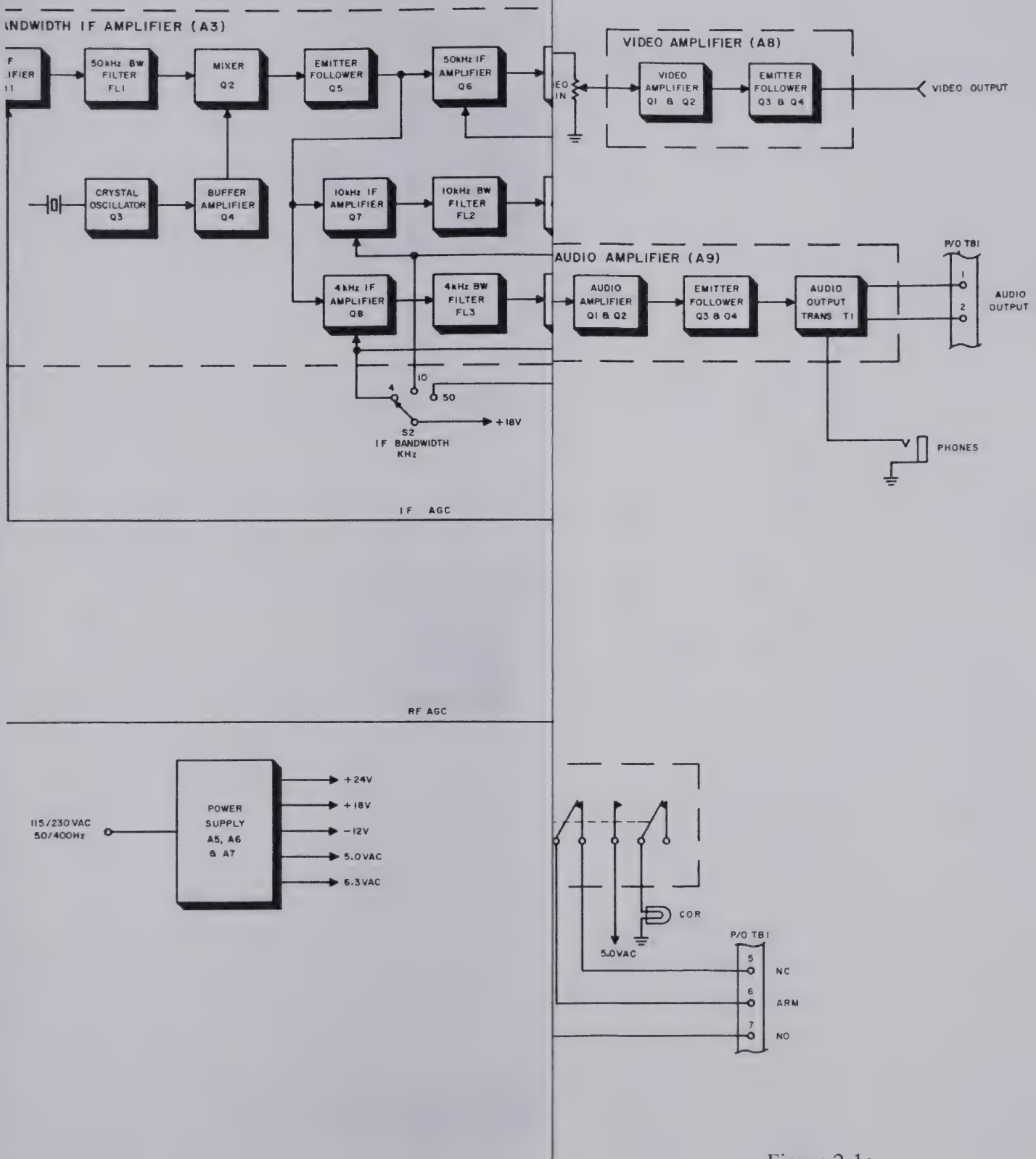


Figure 2-1a

2-0-Aa

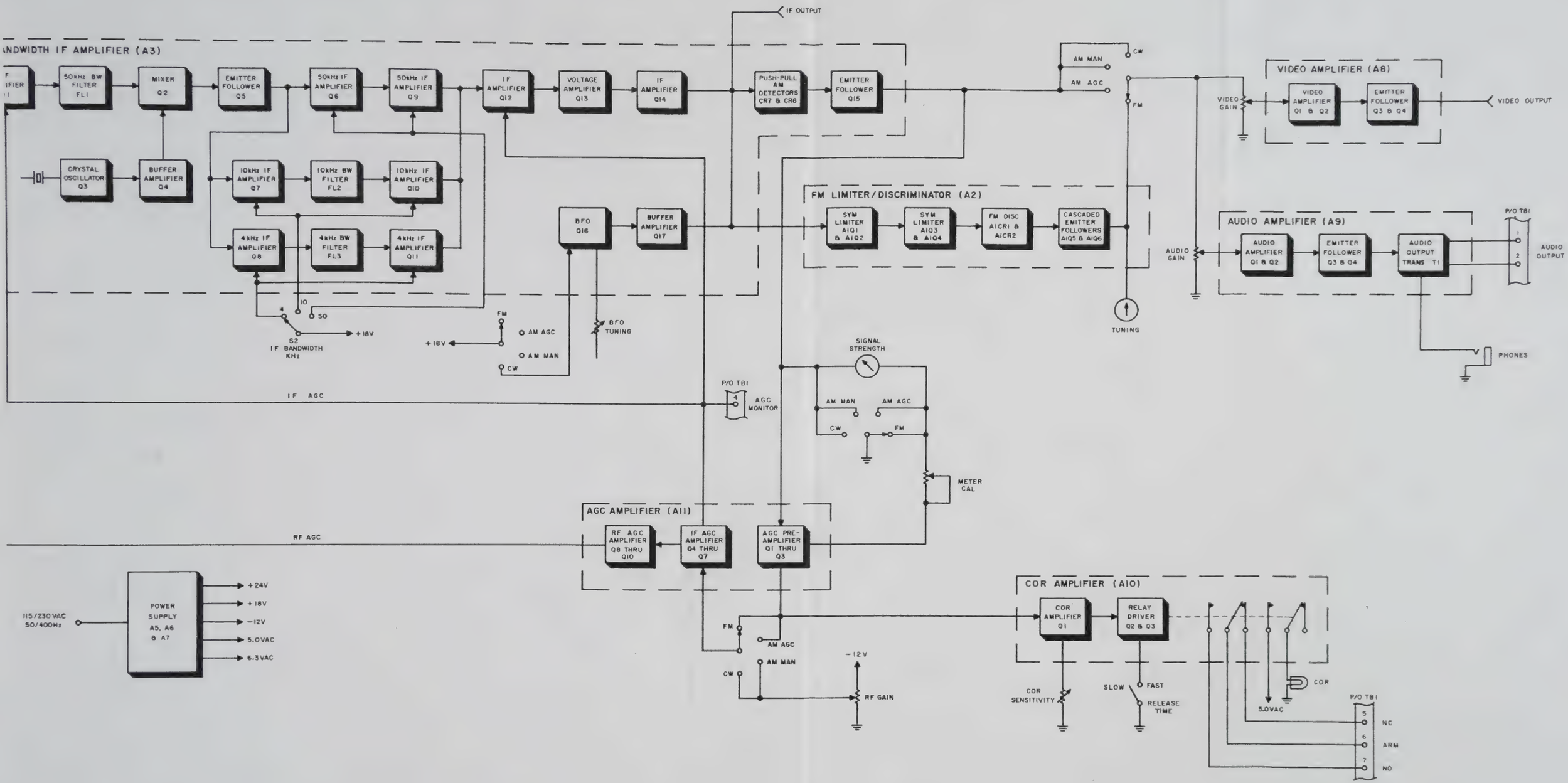


Figure 2-1a
2-0-Aa

Figure 2-2

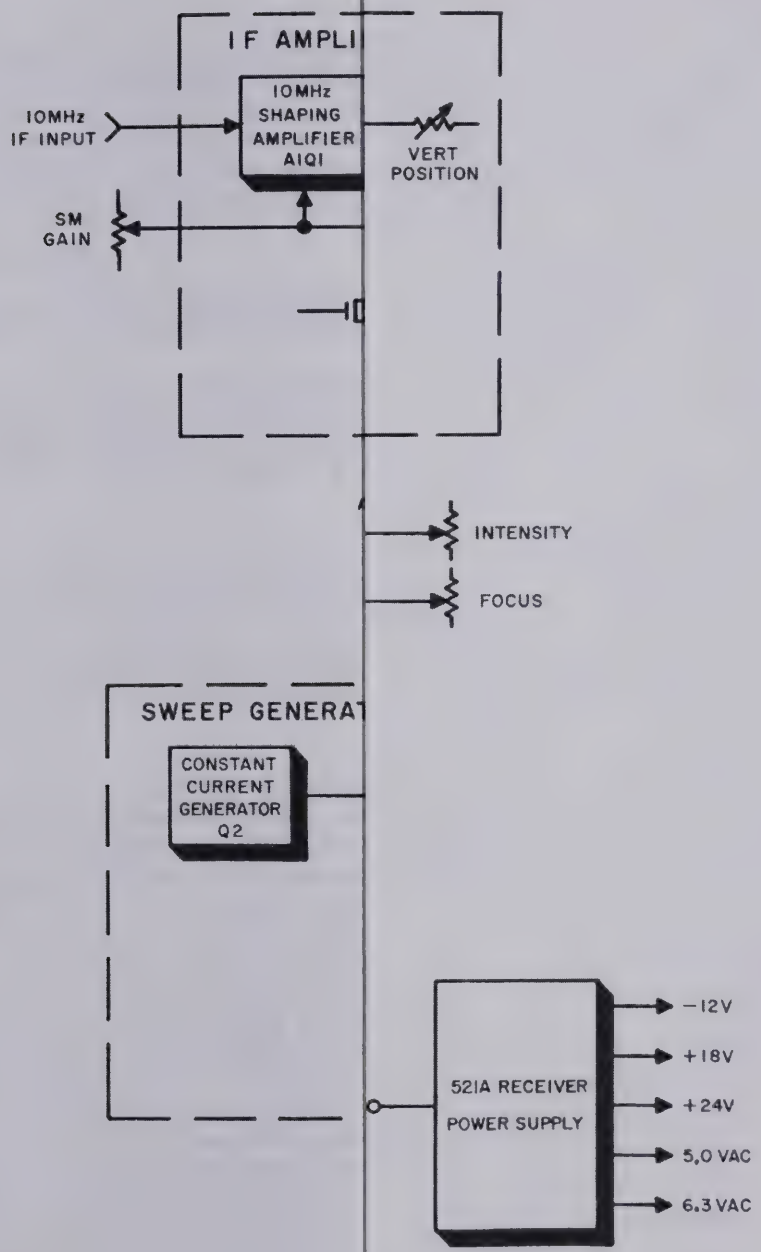


Figure 2-2. Type 79332 Signal
Block Diagram

Figure 2-2

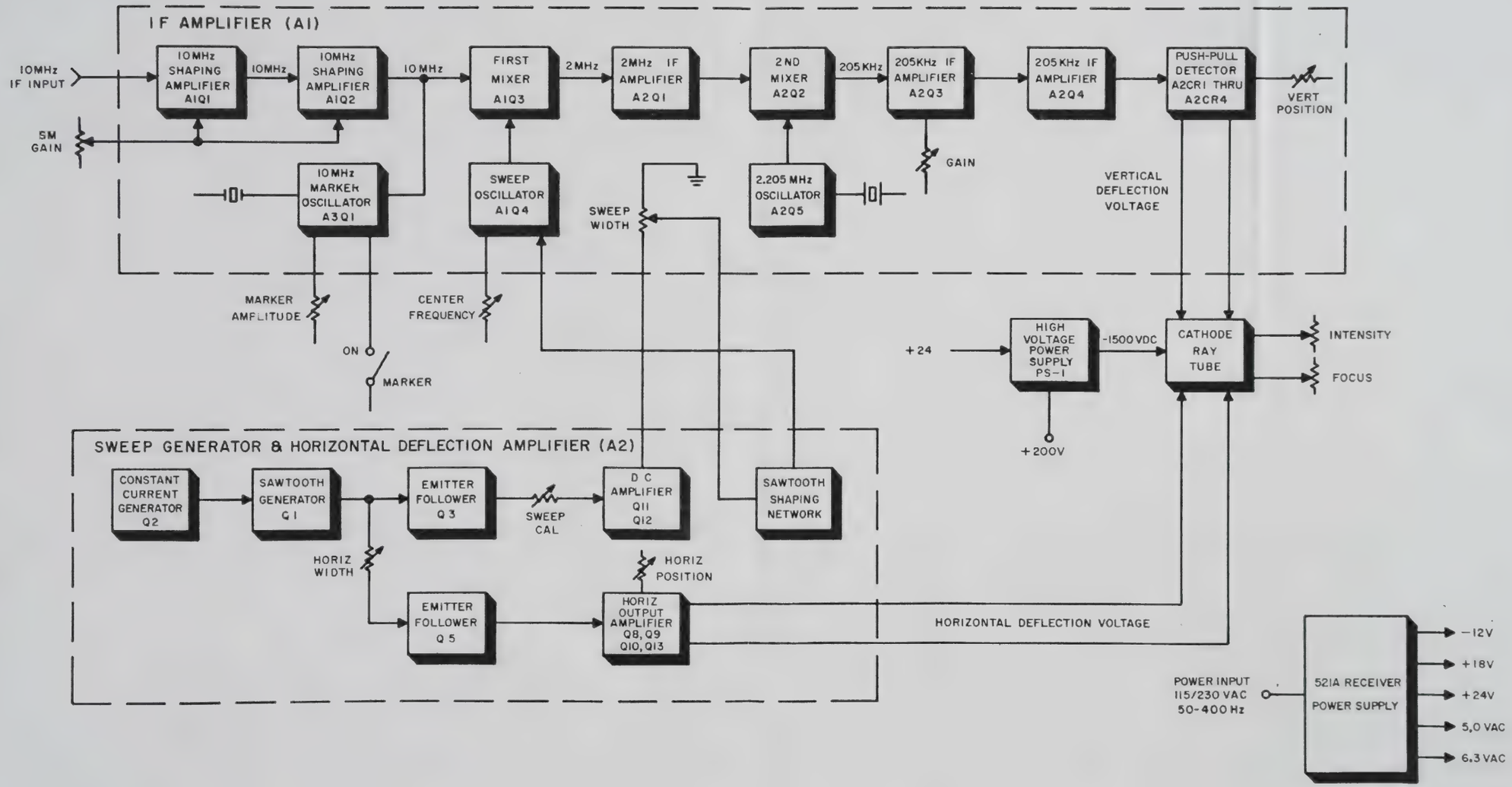


Figure 2-2. Type 79332 Signal Monitor, Functional Block Diagram

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

Operation of the various circuits in the Type 521A receiver and signal monitor is discussed in the following paragraphs using the functional block diagrams, Figures 2-1 and 2-2, and the schematic diagrams, Figures 6-1 through 6-17 at the rear or this manual. Note that the unit numbering method is used for electrical components, which means that parts on subassemblies and modules carry a prefix before the usual class letter and number of the item (such as A1Q1 and A6R1). These subassembly prefixes are omitted on illustrations and in the text except in those cases where confusion might result from their omission.

2.2. FUNCTIONAL DESCRIPTION

2.2.1 The stages associated with the receiving function of the 521A are depicted in the functional block diagram, Figure 2-1. A block diagram of the signal monitor circuitry appears in Figure 2-2.

2.2.2 The 521A receiver is a superheterodyne, double-conversion type designed to tune the 20 to 70-MHz frequency range in one band. Incoming signals are amplified and converted down to 10 MHz before being applied to the IF amplifier. A second oscillator-mixer in the IF strip converts the signal down to 455 kHz. This subassembly provides selectable bandwidths of 4, 10, or 50 kHz. A visual display of the tuned signal is provided by the built-in signal monitor.

2.2.3 RF input signals to the tuner are first amplified by A1Q1, a dual insulated-gate field effect transistor (IGFET). The signals are then fed through an interstage network to the mixer A1A2Q1. The RF bandwidth produced by the interstage network, at the input to the mixer, is 750 kHz, minimum. The local oscillator in the tuner, A1A3Q1, operates 10 MHz above the incoming signal. Transistor A1A3Q2 acts as a buffer stage between the local oscillator and mixer to prevent changing load conditions from affecting the frequency. The 10-MHz difference frequency produced in the mixer is fed to the input of the IF amplifier, and through an impedance-matching network to the input of the signal monitor.

2.2.4 The input stage of the IF strip, A3Q1, is a dual IGFET. Incoming 10-MHz IF signals are fed to the signal gate (gate no.1) and the output is taken at the drain. Gain control of the input stage is by means of an AGC voltage that is applied to the other gate (gate no. 2). Crystal filter A3FL1 sets the bandwidth of the output signal from the drain at 50 kHz. This output is then fed to the mixer A3Q2. The oscillator in the IF strip, A3Q3, is crystal-controlled at a frequency of 10.455 MHz. The oscillator output is fed through buffer amplifier A3Q4 to the mixer, A3Q2, where it is heterodyned to produce the second IF frequency of 455 kHz. This signal is the center frequency of the remaining IF amplifer stages. The mixer output is then fed through a double-tuned circuit to emitter follower Q5. The output from Q5 is simultaneously coupled to the input of three parallel IF amplifier networks. The three paths are similar in that each contains two IF amplifer stages. The IF BANDWIDTH kHz switch, S2, determines which path is operable by supplying bias voltage to the base networks of the IF amplifier stages for the selected bandwidth. Selection of the 4-kHz bandwidth activates the network containing transistors A3Q8 and A3Q11. The bandwidth of this path is determined by crystal filter A3FL3 located in the coupling network between the two stages. Selection of the 10-kHz bandwidth results in the signal being passed through A3Q7, crystal filter A3FL2, and A3Q10. Transistors A3Q6 and A3Q9 are associated with the 50-kHz bandwidth and are activated when this position is selected by switch S2. Coupling between A3Q6 and A3Q9 is by means of a conventional RC network. The IF signal from the path in operation is fed to a fifth amplifier stage A3Q12. This transistor is also a dual IGFET that is gain controlled by the application of AGC voltage to gate no. 2. Transistors A3Q13 and A3Q14 amplify the output signal from A3Q12 and feed it to predetection IF output jack A3J3, to the AM detector, and to the FM limiter/discriminator subassembly, A2.

2.2.5 AM detector diodes A3CR7 and A3CR8 demodulate the IF signal and apply it to emitter follower A3Q15. This stage feeds the AM video signal to the input of the AGC module, and through a section of the function switch to the audio and video gain controls.

2.2.6 The FM limiter/discriminator subassemby, A2, contains two symmetrical limiter stages, A1Q1-A1Q2 and A1Q3-A1Q4, which remove amplitude variations from the video input so that the output varies only in frequency. The limited output is demodulated by an FM discriminator circuit that includes diodes A1CR1 and A1CR2. The FM video signal is then fed through cascaded emitter followers A1Q5 and A1Q6 to the TUNING meter, and through a section of the function switch to the audio and video gain controls.

2.2.7 The video module contains two amplifier stages, A8Q1 and A8Q2, driving emitter followers A8Q3 and A8Q4. The input to the module is obtained from the VIDEO GAIN control, R6. The amplified video output signal is fed to rear-apron VIDEO OUTPUT jack, J5.

2.2.8 The audio amplifier receives its input signal from the AUDIO GAIN potentiometer, R1. Transistors A9Q1 and A9Q2 amplify the input and apply it to emitter followers A9Q3 and A9Q4. Coupling between the emitter followers and the audio output is by means of transformer A9T1. The audio signal appears at rear-apron terminal board TB1 and at the front-panel PHONES jack, J6.

2.2.9 The AGC module contains voltage amplifier stages that produce outputs which are used to control the gain of the RF and IF stages in the receiver. Transistors A11Q1 through A11Q3 form an AGC preamplifier circuit that provides the necessary voltage gain to drive IF AGC amplifiers A11Q4 through A11Q7, and RF AGC amplifiers A11Q8 through A11Q10.

2.2.10 The power supply consists of various main chassis components and regulated power supply boards A5, A6, and A7 that supply -12V, +24V, and +18V, respectively.

2.2.11 The signal monitor (A4) receives its input from an impedance-matching network located on the IF amplifier (see Figure 2-2). This signal, which is the 10-MHz IF output from the RF tuner, is fed to the base of A1A1Q1, the first of two 10-MHz shaping amplifiers. The second amplifier stage, A1A1Q2, is coupled to the first through a double-tuned network. The output from A1A1Q2 is fed to the first mixer through another double-tuned circuit. The bandwidth of the response at the mixer input is 30 kHz, a result of combining the response curve produced by the two interstage networks with that of the mixer output in the RF tuner. The first mixer combines the incoming signal with the output of the sweep oscillator, A1A1Q4, to produce the first signal monitor IF frequency of 2 MHz.

2.2.12 A sawtooth waveform which is used to drive the sweep oscillator originates in the sweep generator and horizontal deflection amplifier, A2. The sawtooth generator, A2Q1, in conjunction with constant current generator A2Q2, produces a wavetrain at a frequency of 22.5 ±5 Hz. The wavetrain is coupled through emitter follower A2Q3 and sweep calibration potentiometer A2R22 to a dc amplifier made up of A2Q11 and A2Q12. The output of the dc amplifier is fed to SWEEP WIDTH kHz potentiometer A1R6. This control varies the amplitude of the sawtooth waveform before it is applied to the sweep oscillator, thus providing the variable 0 to 300-kHz sweepwidth capability of the unit. A modification of the sawtooth wave is performed by the sawtooth shaping network prior to its application to the sweep oscillator circuit. This is done to compensate for the non-linear characteristics of the Varicap modulator in the sweep oscillator network (see paragraph 2.11.1.2).

2.2.13 The sawtooth wavetrain produced by A2Q1 is also used to drive the horizontal deflection plates in the cathode ray tube. The path for the horizontal deflection voltage includes horizontal width potentiometer A2R12, emitter follower A2Q5, and a horizontal output amplifier consisting of transistors A2Q8, A2Q9, A2Q10, and A2Q13. The resultant deflection voltage from this network is applied to the horizontal deflection plates in the CRT. The fact that the waveform that controls the horizontal trace and the sweep oscillator is derived from a common cource explains how synchronization is obtained between the various signals in the incoming RF spectrum and their position on the CRT trace. A horiziontal positioning control, located in the horizontal deflection amplifier circuit, provides a means of centering the trace on the CRT screen. The sweep oscillator, A1A1Q4, has a normal center frequency of 12 MHz. This is 2 MHz higher than the incoming 10-MHz IF signal. Selecting the maximum sweep width (300 kHz) and having the combination of an incoming signal frequency of 9.850 MHz and a sweep oscillator frequency of 11.850 MHz results in a 2-MHz output from the mixer. This then is the first IF frequency for the signal monitor. An incoming signal of 10.150 MHz and a oscillator frequency of 12.150 MHz also combine to produce a 2-MHz difference frequency. These conditions are noted to explain the relationship between the signal monitor IF, the sweep oscillator frequency, and the position of a signal in the incoming spectrum. The modified waveform from the sawtooth shaping network is applied to a voltage-variable capacitor (Varicap) in the sweep oscillator circuit. The capacitance of the Varicap is changed by the impression of the modified sawtooth waveform, thus causing the sweep oscillator frequency to

move up and down in conformance with the amplitude of the impressed wave. Therefore, a 2-MHz signal is developed in the first mixer output circuit as the sweep oscillator changes in frequency and differs from the incoming signal by exactly 2 MHz. Since the horizontal movement of the trace on the CRT is controlled by this same sawtooth wave, the signals from the mixer ultimately appear as vertical pips across the face of the tube in a position which corresponds to their original position in the input spectrum.

2.2.14 The 2-MHz signal from the first mixer is fed through IF amplifier A1A2Q1 to the second mixer, A1A2Q2. It is then heterodyned with the output of the 2.205-MHz crystal oscillator, A1A2Q5, to produce the second IF frequency of 205 kHz. Transistors A1A2Q3 and A1A2Q4 amplify the signal and apply it to a voltage-doubling, push-pull detector circuit. The output from the detector consists of two signals of equal amplitude, but of opposite polarity, which are applied to the vertical deflection plates of the CRT.

2.2.15 The gain of the signal monitor is controlled by the front-panel SM GAIN potentiometer, A1R1, which varies the bias on the bases of the 10-MHz shaping amplifiers. Controlling the gain of these stages sets the amplitude of the pips on the screen. The vertical position of the trace on the CRT screen is adjusted by the vertical position control, A1A2R25, which functions in conjunction with the push-pull detector circuit. The marker switch, A4S1, activates the 10-MHz marker oscillator, A1A3Q1, and results in a pip on the CRT screen which represents the center of the IF response. This aids in receiver tuning and in determining the frequency of incoming signals. The CENTER FREQ control, A1R3, varies the bias level on the Varicap modulator to provide vernier control of the sweep oscillator center frequency. High voltage for the CRT is provided by a dc-to-dc converter, PS1, which is located on the top of the signal monitor chassis. The remaining voltages required for operation of the unit are provided by the receiver power supply.

2.3 TYPE 71187 20-70 MHz RF TUNER

Figure 6-1 is the schematic diagram for the type 71207 RF tuner assembly; its reference designation prefix is A1. The schematic diagram for the type 71187 20-70 MHz RF tuner is Figure 6-2; its reference designation prefix is A1A1.

2.3.1 RF Amplifier. - The RF amplifier in the tuner, Q1, is a type TA2644 dual IGFET. This semiconductor is essentially two single-gate stages connected in cascode. Incoming RF signals are fed to gate no. 1 of the stage from the input network which is tuned by L1A, one section of a four-section inductuner. Impedance matching between the 50-ohm antenna and the input network is by means of a capacitive voltage divider consisting of A1C1 and A1C2. Resistor A1R1 shunts to ground any electrostatic voltage that may build up on the antenna. A positive bias developed across resistors A1R2 and A1R3 is applied to gate no. 1 to stabilize the current through the stage. The gain of Q1 is controlled by a negative-going voltage which is supplied by the AGC amplifier when the signal-to-noise ratio at the receiver's output reaches approximately 10 dB. This gain control voltage is applied to gate no. 2 of Q1 through resistors R1 and R2. Until this time the tuner operates at maximum gain. Diode A1CR1 clamps gate no. 2 of Q1 to prevent this point from ever going more positive than 0.6 volts. This diode is forward bised from the +18-volt supply through resistors A2R2 and R2, until AGC action begins and the voltage reaches approximately -1.0 volts. At this time the diode will be reverse biased and the gain of Q1 will be reduced. The output signal from the RF amplifier is taken from the drain and fed through parasitic suppressor R1 to the complex interstage network. Split-C tuning is used to maintain the desired bandwidth and gain throughout the tuning range. This network is essentially a double-tuned bandpass filter. One-half of the filter capacitance (A2C1 plus A2C2 and A2C10 plus A2C9) appears across the entire inductance while the other half (A2C3, A2C11) appears only across the inductuner sections. Section L1B tunes the output of the RF amplifier and section L1C tunes the input to the mixer. Inductors A2L1 and A2L2 provide additional inductance at the high end of the band since the inductuner is reaching its high end limit. Increased coupling through the network at the low-frequency end of the band is provided by A2C6 and A2C7. These two components are connected in parallel with A2C5 by the action of a network consisting of A2L3 and A2C8. This network is resonant just below the low-frequency end of the tuning range and therefore presents a high impedance at the junction of A2C6 and A2C7 when the tuning approaches 20 MHz. These two capacitors have little effect on the network at the high-frequency end of the band. Resistor A2R4 provides additional loading of the filter network at the low-frequency end. This is done so that the tuner gain will be relatively constant over the entire band.

2.3.2 Local Oscillator. - The local oscillator in the tuner, A3Q1, operates in a Colpitts configuration at a frequency 10-MHz higher than the incoming signal. Regenerative feedback to sustain oscillation is taken at the junction of capacitors A3C1 and A3C2 and fed through A3R2 to the base. This resistor also improves the linearity of the sine-wave output from the oscillator. The oscillator tank circuit is tuned by section L1D of the inductuner. Capacitor A3C3 has a negative temperature coefficient to compensate for frequency drift due to ambient temperature change.

The pitch of the CW-audio beat note is varied by changing the voltage applied to voltage variable capacitor (Varicap) A3CR1. This semiconductor is effectively in parallel with the oscillator tank circuit. The capacitance of A3CR1 varies inversely with the reverse voltage applied across it. This bias voltage is supplied by the front-panel BFO TUNING control, R4. For example, rotation of R4 in the clockwise direction increases the reverse bias on A3CR1 and decreases its capacitance. Thus, the tank circuit frequency is increased and with it, the CW-audio beat note. Transistor A3Q2, an emitter follower, functions as a buffer to isolate the oscillator from any changes in the load at the local oscillator and tuner outputs that might affect the frequency. This stage also provides the proper impedance transformation from the oscillator to the mixer. The input to A3Q2 is from a capacitive voltage divider consisting of A3C7 and A3C8. These two components also exhibit a negative temperature coefficient. Additional compensation of oscillator drift is provided by Varicap CR1 when the optional frequency counter is used. A correction voltage from the DAFC circuit in the counter is applied to the anode of CR1 through front-panel EXT AFC switch S4. The level and polarity of the correction voltage, and thus the amount of frequency change, is a function of the amount of drift sensed by the counting circuits. Zener diode A3CR2 regulates the fixed bias voltage applied to the cathode of CR1. This bias voltage sets the nominal capacity of the Varicap. Thus, when the correction voltage is at zero the capacity of CR1 does not affect the oscillator frequency. Transformer A3T1 provides a 50-ohm output impedance at LO OUTPUT jack J2 on the rear apron. The local oscillator signal is coupled from A3Q2 to the mixer through capacitor C9.

2.3.3 Mixer.-The mixer stage, A2Q1, is a type 3N128 IGFET. The signal from the interstage network is fed to the gate and the local oscillator signal is coupled to the source. The signals are heterodyned to produce the 10-MHz difference frequency which is taken at the drain. Local oscillator radiation is reduced by the action of a neutralization network composed of the inter-element capacitance of A2Q1, capacitor A2C12 and transformer A2T1. The latter component is center-tapped resulting in a 1:1 turns ratio. Capacitor A2C13 places the center tap at ac ground potential, as well as bypasses source resistor A2R5. The neutralization components are connected to form a balanced bridge network. Any local oscillator signal conducted through the inter-element capacitance of A2Q1 is largely cancelled by a signal of equal amplitude, but of opposite polarity that is fed through the other leg of the bridge. Test point TP1 is included in the source circuit of A2Q1 to permit measurement of the oscillator injection level and monitoring of the interstage response by means of a wideband oscilloscope. The 10-MHz IF signal from the drain is coupled to the IF amplifier through a single-tuned circuit consisting of capacitor A2C15, inductor L2 and capacitor C8. This network peaks the mixer output at 10MHz. Blocking capacitor C7 prevents +18 Vdc from being applied to jack J2.

2.4 TYPE 72186 4/10/50-kHz BANDWIDTH IF AMPLIFIER

The schematic diagram for the IF amplifier is Figure 6-4; parts on this subassembly carry the reference designation prefix A3. The 10-MHz IF output from the RF tuner is connected to jack J1. The signal is then fed through a resistive voltage divider (R1, R3) and output jack J2, to the input of the signal monitor. The input at J1 is also coupled to the input of the first IF amplifier through C13.

2.4.1 First IF Amplifier.- The input stage of the IF amplifier, Q1 is a type TA-2644 dual IGFET. The incoming IF signal is coupled to gate no. 1 and the output is taken at the drain. The stage is gain controlled by the application of a negative-going voltage to gate no. 2. The AGC voltage is applied to Q1 through resistors R2, R5, and R6. Diode CR1 clamps the AGC line to prevent it from ever going more positive than +0.6V. The stage operates at maximum gain until AGC action begins. When the input signal reaches a predetermined level, the forward bias on CR1 is overcome and the gain of Q1 is reduced. Capacitor C14 holds the gain-controlled gate at ac ground potential. The output impedance of Q1 is matched to the input impedance of crystal filter FL1 by means of a capacitive voltage divider made up of C20 and C21. The crystal filter sets the bandwidth of the output signal from the first IF stage at 50 kHz. Capacitor C24 couples the signal from FL1 to the input of the mixer.

2.4.2 Crystal Oscillator and Buffer.- Transistor Q3 operates in a crystal-controlled, Colpitts oscillator configuration at a frequency of 10.455 MHz. Oscillation is sustained by the application of positive feedback to the transistor's base. This feedback signal is taken at the junction of resistors R15 and R16 and coupled to the base through C16. The 10.455-MHz oscillator signal is taken from the junction of resistors R16 and R18 and fed to the base of buffer amplifier Q4 through capacitor C22. This transistor isolates the oscillator from any load changes occuring at the mixer input which may affect the fundamental frequency. Capacitor C25 couples the buffer output to the gate of the mixer.

2.4.3 Mixer. - A second conversion of the incoming signal occurs in the second mixer, Q2. This stage utlilizes a type-3N128 IGFET. Both the incoming 10-MHz IF signal and the 10.455-MHz oscillator signal are connected to the gate. Transistor Q2 heterodynes the two signals to produce the 455-kHz second IF frequency which is taken at the drain. Test point TP1 has been included in the source circuit to provide a means of monitoring the response of the network between Q1 and Q2, as well as the injection level of the oscillator, with a wideband oscilloscope. Resistor R24, in the drain circuit of Q2, functions as a parasitic suppressor. The 455-kHz signal from Q2 is fed through a double-tuned circuit to the base of emitter follower Q5.

2.4.4 4-kHz, 10-kHz, 50-kHz Bandwidth IF Amplifiers. - The output signal from emitter follower Q5 is fed through one of three parallel paths to subsequent stages in the IF strip. The three paths are similar in that each contains two IF amplifier stages. IF BANDWIDTH kHz switch S2 determines which path is operable by supplying base bias to the transistors for the selected bandwidth. Placing S2 in the 4-kHz position activates transistors Q8 and Q11. Ceramic filter FL3 sets the bandwidth of the network. Transistors Q7 and Q10 are activated when the 10-kHz posi- is selected. Ceramic filter FL2 determines the bandwidth of this path. Conventional RC coupling is used between Q6 and Q9 which are associated with the 50-kHz path. The bandwidth of the signal at the base of Q5 was previously determined by FL1. Emitter resistors R44 through R47 are used to equalize the gain of all three bandwidth paths. When Q6 is conducting all four resistors are included in the emitter circuit. This sets the desired gain of the 50-kHz path. Increased gain through the 10-kHz path is provided when Q7 is conducting and resistors R45 through R47 are active in the emitter circuit. A still greater increase in gain is required with the 4-kHz bandwidth. In this case the emitter circuit for Q8 utilizes R46 and R47 only. The output stages for each path (Q9, Q10, Q11) share a common emitter resistor, R60. In addition to providing the dc return path for the conducting stage, R60 aids in the elimination of feed-through from the non-conducting paths. The voltage developed across this resistor reverse biases the emitter-base junctions of the two remaining transistors, cutting them off even harder. The signal from the path in operation is coupled through dc-blocking capacitor C47 to the succeeding amplifier stages.

2.4.5 IF and DC Amplifiers. - Transistor Q12 is a type TA2644 dual IGFET. This stage functions as the second IF amplifier which is common to all three bandwidths. It is gain controlled by the same method used for Q1. Incoming signals are applied to gate no. 1, and output signals are taken at the drain connection. Coupling capacitor C56 feed the signal from Q12 to the base of Q13, a dc amplifier. This stage has been included to provide the necessary drive for IF amplifier Q14 when high-level input signals are present. When this condition exists, the gain of Q12 is greatly reduced by the action of the applied AGC voltage, thus lowering its output. This loss of signal voltage is compensated for by Q13. The output from IF amplifier Q14 is simultaneously fed to transformer T1, through a capacitive voltage divider to the IF output jack J3, and to the FM limiters in A2.

2.4.6 Push-Pull Detector. - Silicon diodes CR7 and CR8 are connected in a push-pull detector circuit. The secondary of transformer T1 is center-tapped to provide the necessary detector input signals. The full-wave configuration is utilized to minimize ripple that would occur in a conventional detector output circuit, as well as to provide a wider video bandwidth. Diode CR6 compensates for the base-emitter voltage drop of output stage Q15 so that the AM video output will be zero volts with no signal input. The clamp voltage appears on both sides of the detector diodes so that their operation is not affected. Emitter follower Q15 feeds the demodulated output from CR7 and CR8 to the input of the AGC amplifier, and through a section of the function switch to the audio and video gain controls. Inductor L7 and capacitor C70 form a filter that eliminates any remaining 455-kHz IF component from the AM video output.

2.4.7 Beat Frequency Oscillator. - Transistor Q16 functions as a BFO in a modified Hartley configuration. The operating frequency of 455 kHz is determined by C51, CR2, CR3, and T2. The latter component is tapped to provide the necessary regenerative feedback. A parallel pair of voltage variable capacitors (Varicaps) are connected across the oscillator tank circuit to provide a means of changing the pitch of the CW-audio beat note. A voltage variable capacitor is a semiconductor device whose capacitance varies inversely with the reverse voltage applied across it. As the front-panel BFO TUNING potentiometer, R4, is rotated, a varying voltage is applied to CR2 and CR3 changing their capacitance. Consequently, the frequency of the oscillator is changed and with it the beat of the CW-audio signal. Silicon diode CR4 has been included for temperature compensation of CR2 and CR3. Two Varicaps are used to obtain the needed amount of capacity at the 455-kHz frequency. The BFO output from the emitter of Q16 is fed through resistor R78 and capacitor C59 to the base of buffer stage Q17. This stage prevents changes in the load from affecting the oscillator stability and operating frequency. Limiting of the signal at the base of Q16 is performed by the action of diode CR5, capacitor C60 and resistor R85. The diode is reverse biased by approximately +2.7 volts which is developed across emitter resistor R84. If the peak of the sine-wave at the base of Q16 exceeds approximately +3.3 volts, CR5 will be forward biased and signal voltage in excess of the reverse biasing level will

be shorted to ground through C60. This is done to compensate for differing electrical parameters of various 2N3933 transistors. The positive-going half cycle at the base of Q17 results in an increase in the voltage developed across R84. Normally, this would tend to hold CR5 in a cut off condition. However, the filtering action of R85 and C60 causes this voltage change to be very slight and, since the diode is only forward biased during the period when the signal is at its positive peak, therefore has little effect. The limiting action prevents the BFO signal from overloading the AM detector and causing damage to subsequent stages. The output from Q17 is taken at the collector and injected into the AM detector circuit at the junction of R83 and R86.

2.5 TYPE 79331 FM LIMITER/DISCRIMINATOR

The schematic diagram for this subassemby is Figure 6-3; its reference designation prefix is A2.

2.5.1 FM Limiters. - Two symmetrical limiter stages, A1Q1-A1Q2 and A1Q3-A1Q4, remove amplitude variations from the incoming signal so that the input to the discriminator varies only in frequency. The input to A1Q1 swings about a positive dc level of approximately +3 volts established by base-bias resistors A1R1 and A1R2. Similar networks are in the base circuits of A1Q2, A1Q3, and A1Q4. Capacitors A1C2 and A1C8 provide ac coupling between the first and second stages of each limiter. This permits independent dc operation as well as the use of different transistor types. Under no-signal conditions the emitter currents of A1Q1 and A1Q2 develop a nominal voltage across their respective emitter resistors. When a signal is applied to the base of A1Q1, the positive-going half cycle causes increased conduction through A1Q1 which increases the voltage drop across A1R3. This changing emitter signal is coupled to A1Q2 through A1C2. Since this positive-going signal is being applied to the emitter, the stage is driven toward cut off. If the input signal has sufficient amplitude, the base-emitter junction will be completely reverse biased. On the negative-going half cycle the decreased drop across A1R3 will cause A1Q2 to conduct to saturation. Thus the transistor operates between cut off and saturated conditions, limiting both the positive and negative half cycles of the input signal. Capacitor A1C3 holds the base of A1Q2 at RF ground potential. The signal from the collector of A1Q2 is coupled to the second limiter by capacitor A1C4. Diodes A1CR3 and A1CR4 provide additional limiting of signal amplitudes in excess of ±0.6 volts. The operation of the second limiter is identical to that of the first.

2.5.2 FM Discriminator. - The FM discriminator is a modified Foster-Seeley circuit. The 455-kHz signal from the second limiter is fed directly to the primary of discriminator transformer A1T1 through variable inductor A1L3. Both components are tuned to the IF frequency. An inductive voltage divider is formed by A1L3 and the primary of A1T1 with only a very small percentage of the limiter output appearing across the transformer primary. Capacitor A1C11 couples the RF reference voltage to the transformer secondary. Diodes A1CR1 and A1CR2 demodulate the FM signal and apply it to cascaded emitter followers Q5 and Q6. The video output from the emitter followers is fed to the FM position on section S1B-X of the function switch and through resistor R1 to the TUNING meter. Inductor A1L2 and capacitor A1C16 form a filter to eliminate any 455-kHz component remaining in the video output.

2.6 TYPE 79316 AGC AMPLIFIER

Figure 6-16 is the schematic diagram for the AGC amplifier; its reference designation prefix is A11. This module contains amplifier stages that provide gain control voltage for the RF tuner and IF amplifier.

2.6.1 IF AGC. - The input signal to the module is the positive-going AM detector output. It is fed to the base of IF AGC preamplifier Q1 through resistor R2. Filtering of the input signal is provided by C1. Reverse biasing of the base-emitter junction of Q1 from the +18V supply through R4 provides the desired delay prior to AGC action. The point at which the transistor becomes forward biased is when the signal-to-noise ratio at the receiver's output reaches approximately 10 dB. Until this time Q2 is conducting heavily with emitter current flowing through CR1, CR2, and R7. When Q1 conducts, the collector signal reduces the conduction through Q2. The emitter voltage of Q2 then drops to approximately +13 volts. The AGC preamplifier voltage is taken from the emitter of Q3, which is at zero volts due to the compensation provided by CR3 and CR4. As the incoming signal amplitude continues to increase, the voltage at the emitter of Q2 continues to decrease causing an approximately equal emitter voltage decrease on Q3. This emitter signal is then fed through pin 11 of the module to the AM AGC and FM positions on function switch section S1A-W. It is also used as the input to the carrier operated relay module A10. An additional modulation filter, consisting of C2 and R33, is connected at the junction of CR1 and CR3. Current to operate the SIGNAL STRENGTH meter, when the AGC circuit is operating, is also derived from Q3. This current is fed through diode CR5, resistor R10, and potentiometer R11 (on the main chassis) to meter M2. The diode prevents movement of the meter needle until the voltage output exceeds -0.6 volts. An AGC monitor is also provided from this output

through resistor R9. It is fed to pin no. 4 of rear-apron terminal board TB1. Placing switch S1 in the AM AGC or FM positions results in the preamplifier output at pin eleven being fed to pin eight. From this point the signal passes through resistor R12 to cascaded emitter followers Q4 and Q6. The resultant output from the emitter of Q6 (pin nine) is a signal that increases, in the negative direction, an equal amount for a given input voltage change on the base of Q4. Thus, a one-volt change on pin eleven results in a one-volt change at the IF AGC output (pine nine). The IF AGC voltage is fed directly to the gain controlled stages in the IF amplifier. A change in the slope of the IF AGC characteristic curve occurs as the voltage amplitude at the emitter of Q6 exceeds approximately 3.6 volts. This slope change is a result of the action of transistor Q5, whose function resembles that of a Zener diode. Under no signal conditions, the reverse bias voltage on the base, determined by resistors R16, R17, R18, and R20, is approximately -3.0 volts and the stage is cut off. As the negative-going signal on the emitter exceeds the reverse bias voltage, the stage conducts and resistor R14 is added to the circuit. The result is an IF AGC output that continues to increase with an increasing input voltage but at a reduced voltage gain.

2.6.2 RF AGC.-Transistor Q7 performs essentially the same function as Q5. The reverse bias on the base of this stage is approximately -2.5 volts. As the incoming signal at pin eleven approaches approximately -3.1 volts, Q7 conducts, causing current flow through the stage and resistors R22, R23 and R24. The voltage at the base of Q8 rises rapidly to -0.5 volts, at which time CR6 is forward biased shunting resistor R24. Resistors R22, R23, R24 and diode CR6 form a voltage shaping network for the RF AGC. The gain of the receiver is primarily controlled by the RF AGC voltage once these circuits begin to function. Transistors Q8 and Q9 are connected in a differential feedback amplifier configuration. The input signal on the base of Q8, and the feedback signal on the base of Q9 are summed in the common emitter circuit to produce a signal on the collector of Q8 that is the difference between the two inputs. This signal is fed directly to the base of voltage amplifier Q10. Two outputs are provided by this stage. One is the feedback signal developed at the junction of resistors R28 and R29. This signal sets the voltage gain of the over-all amplifier at a factor of three. The second output is the RF AGC signal which is taken at the junction of R28 and R30, and fed through R31 to the gain-controlled stage in the RF tuner.

2.6.3 Manual Gain Control.- When switch S1 is placed in the AM MAN or CW positions the gain of the receiver is controlled by the front-panel RF GAIN potentiometer, R5. Bias voltage from this control is fed to the AGC module through pin eight. Rotating R5 in the counterclockwise direction increases the reverse bias applied to emitter follower Q4 and has the same effect as the negative going input that is supplied from pin eleven during AGC; namely decreasing the forward bias on the gain-controlled IF and RF stages, and lowering the gain of the receiver. Transistors Q5 through Q10 function as they do when the AGC circuits are in operation.

2.6.4 Signal Strength Meter.-The polarity of SIGNAL STRENGTH meter M2 is reversed by section S1A-X of the function switch, depending on the operating mode selected. The current path through the meter when the AM AGC or FM modes are selected is through transistor Q3, diode CR5, resistor R10, main chassis meter calibrate potentiometer R11, and meter M2 to ground. Selection of the AM MAN or CW modes results in the terminal of M2 that is connected to potentiometer R11 being positive with respect to ground. Current flow is then from the AM detector, through resistor R1 on the module, through the meter and the function switch to ground.

2.7 TYPE 7338 VIDEO AMPLIFIER

The schematic diagram for the video amplifier is Figure 6-13; its reference designation prefix is A8. The module consists of an NPN transistor, Q1, dc-coupled to Q2, a PNP transistor. These two stages provide the necessary voltage gain to drive complementary summetry emitter followers Q3 and Q4. The latter two transistors are biased to operate Class B. Negative dc feedback to set the over-all gain of the amplifier is taken at the junction of emitter resistors R11 and R12 and fed to the emitter of Q1 through R6. Silicon diodes CR1 and CR2 serve three functions. First, they determine the idling currents of Q3 and Q4. Secondly, they eliminate crossover distortion while preventing thermal runaway. And third, they compensate for the base-emitter voltage drops of Q3 and Q4. Since the transistors and diodes are made of the same material they exhibit the same temperature coefficient of voltage characteristics. A rise in temperature lowers the base-emitter voltage drop of the transistors tending to make them conduct harder. However, the diode voltage drop decreases by the same amount so that the voltage applied to the bases also decreases, holding the collector current nearly constant. Resistors R11 and R12 are included in the emitter circuits of Q3 and Q4 to provide additional feedback with low-input signal levels. These resistors permit an imperfect match between diodes CR1 and CR2 and the base emitter junctions of Q3 and Q4. With little or no input signal the drop across the resistors is a few tenths of a volt. Large input signals would cause the drop to become excessive except that CR3 and CR4 become forward bised and limit the drop to approximately 0.6 volt.

The low-impedance output of the complementary symmetry emitter followers is matched to the higher impedance output terminals by means of R13. This resistor has the additional effect of preventing amplifier damage if the output terminal is accidentally shorted to ground. Resistor R14 provides a discharge path to ground for C6 if the amplifier is operated without a dc load. Capacitor C3 provides additional drive for Q4 through R9 during the negative-going portion of the input signal. The base of Q3 and Q4 are coupled through capacitor C4 to equalize the input signal level to the two stages. The output signal from the module is fed to the rear-apron VIDEO OUTPUT jack, J6.

2.8 TYPE 7424 AUDIO MODULE

The schematic diagram for the audio module is Figure 6-14; its reference designation prefix is A9. The module consists of NPN transistor, Q1, dc-coupled to Q2, a PNP transistor. These two stages provide the necessary voltage gain to drive complementary symmetry emitter followers Q3 and Q4. The latter two transistors are biased to operate Class B. Negative dc feedback to set the over-all gain of the amplifier is taken at the junction of emitter resistors R11 and R12 and fed to the emitter of Q1 through R7. Silicon diodes CR1 and CR2 serve three functions. First, they determine the idling currents of Q3 and Q4. Secondly, they eliminate crossover distortion while preventing thermal runaway. And third, they compensate for the base-emitter voltage drops of Q3 and Q4. Since the transistors and diodes are made of the same material they exhibit the same temperature coefficient of voltage characteristics. A rise in temperature lowers the base-emitter voltage drop of the transistors tending to make them conduct harder. However, the diode voltage drop decreases by the same amount so that the voltage applied to the bases also decrease, holding the collector current nearly constant. Resistors R11 and R12 are included in the emitter circuits of Q3 and Q4 to provide additional feedback with low-input signal levels. These resistors permit an imperfect match between diodes CR1 and CR2 and the base-emitter junctions of Q3 and Q4. With little or no input signal the drop across the resistors is a few tenths of a volt. Large input signals would cause the drop to become excessive except that CR3 and CR4 become forward biased and limit the drop to approximately 0.6 volt. The low-impedance output of the complementary symmetry emitter follower is matched to the higher impedance output terminals by means of R13. Capacitor C2 provides additional drive through R9 for Q4 during the negative-going portion of the input signal. Additional negative feedback to stabilize the amplifier is produced by the current flow through the primary of output transformer T1 and resistor R6.

2.9 TYPE 7509 CARRIER OPERATED RELAY

Figure 6-15 is the schematic diagram for this module; its reference designation prefix is A10.

2.9.1 The first stage of the module, Q1, is a dc amplifier. The second and third stages, Q2 and Q3, are a combination switch relay driver and time-delay network. The input to the module is the negative-going signal from pin eleven of the AGC amplifier. It is applied to the base of Q1 through resistor R10. The front-panel COR SENSITIVITY control, R2, determines the input signal level required to actuate the relay. A positive voltage from the arm of the potentiometer is applied to the base of Q1 through R1, forward biasing the stage. When Q1 is conducting the other stages on the module are cut off. Diode CR1 clamps the base of Q1 to prevent the voltage at this point from ever going more negative than -0.6 volts. Diode CR2 is forward biased from the -12 volt supply through R5 and R6, thus clamping the emitter of Q1 at -0.6 volts. Resistor R2 connects the base of Q1 to the -12V supply so that when the COR SENSITIVITY control is fully clockwise, the voltage at this point will be zero. Hence, the incoming signal need only reach -0.6 volts for Q1 to be cut off.

2.9.2 Once Q1 is cut off, the positive voltage at the junction of resistors R4 and R7 turns on Q2 and Q3. Current then flows from ground, through Q3 and the relay coil, causing K1 to actuate. Q2 and Q3 are connected in a Darlington configuration so that variations in transistor beta will not affect the timing of the delay circuit.

2.9.3 With the COR FAST-SLOW switch, S3, in the FAST position K1 releases almost immediately after the input signal to Q1 decreases below the sensitivity level. Placing S3 in the SLOW position isolates C2 from ground through surge-limiting resistor R9. This results in the relay holding for approximately 6.0 seconds after Q1 starts conducting. This delay is provided by C2 in conjunction with CR3 and CR4. At the time Q2 and Q3 conduct to energize K1, C2 discharges to ground through CR4. When the input signal disappears, the capacitor charges through R7 and CR3. This RC time constant, in parallel with the input resistance of the Q2-Q3 combination, determines how long the relay remains activated in the absence of the input signal. It is the charging current for C2 through R7 that develops the base voltage to keep Q2 and Q3 conducting. Once the charging current has decreased to the point that the voltage developed across R7 is insufficient to keep the base-emitter junction of the two transistors forward biased, they cut off and K1 is de-energized. Capacitor C2 holds its charge until Q2 and Q3 again conduct as the result of an input

signal of sufficient amplitude to the COR module to cut Q1 off. When this occurs the collector voltage of Q2 and Q3 suddenly drops. Since the voltage across C2 cannot change instantaneously, the end connected at the junction of CR3 and CR4 swings below ground potential. This forward biases CR4 and C2 discharges through the diode.

2.10 POWER SUPPLY

The 521A Receiver is designed to operate from a 115 or 230 Vac, 50-400 Hz source. The path for the ac input (see Figure 6-16) is from power plug P11, through power line filter FL1, line fuse F1, and POWER switch S5, (which is ganged with the audio gain control) to the primary windings on power transformer T1. Power selector switch S6 is used to connect the two primary windings in parallel for 115-volt operation and in series for 230-volt operation. Line fuse F2 provides additional overload protection when the latter input power is used. The power transformer has four secondary windings. Two of these, 5-6 and 7-8, supply the ac input to the +18 Vdc and -12 Vdc, and the +24 Vdc regulated power supply boards, respectively. Winding 11-12 supplies 5.0 Vac to operate the dial lamps. The fourth winding 9-10, supplies 6.3 Vac for the filament in the cathode ray tube.

2.10.1 Type 76118A -12V Regulated Power Supply Board. - The schematic diagram for this module is Figure 6-10; its reference designation prefix is A5. Transistor Q1 functions as a series regulator whose conduction is controlled by Q2, a voltage amplifier. Transistors Q3 and Q4 are connected in a differential amplifier configuration. The base of Q4 is held at a fixed potential by Zener diode CR2. The base of Q3 is connected to the regulated output through a sampling network consisting of fixed resistors R5 and R7, and potentiometer R6. The signals at the bases of the two stages are summed in the common emitter circuit to produce a signal at the collector of Q3 that is the difference between the two inputs. Thus, any fluctuation in the output voltage is sensed by Q3, amplified and inverted and fed to the base of Q2. For example, if the output voltage rises (becomes more negative) Q3 will conduct harder, causing an increased voltage drop across R2 and R3. This lowers the forward bias voltage and the current flow through Q2. As a result, the current flow through Q1 is reduced, returning the output voltage to its nominal value. Resistor R4 connects the base of Q3 to the input side of the regulator so that voltage fluctuations at this point can be sensed and compensated for by Q1. A differential amplifier is used in the comparison circuit as variations in base-emitter voltage due to temperature changes in one transistor will tend to cancel similar changes in the other. This configuration also permits the reference diode, CR2, to be placed in the base circuit rather than the emitter, as is the case with a one-stage error amplifier. Less current flows through the diode, resulting in a more stable reference voltage.

2.10.2 Type 76121A +24V Regulated Power Supply Board. - The schematic diagram for this module is Figure 6-11; its reference designation prefix is A6. The operation of this module is similar to module A5. The polarity of the diodes, transistors, and capacitors has been reversed to supply the positive voltage. In addition, a higher ac input voltage is used. Transistor Q2 functions as a emitter follower in this case to amplify the low current output of Q3. This configuration is used to provide sufficient current drive for the low-input impedance at the base of Q1.

2.10.3 Type 76124 +18V Regulated Power Supply Board. - Figure 6-12 is the schematic diagram for this module; its reference designation prefix is A7. Operation of this power supply board is identical to the +24V module, as described in paragraph 2.10.2.

2.11 SIGNAL MONITOR

The following paragraphs contain a description of the circuits in the type 79332 Signal Monitor. The schematic diagram for the main chassis of this subassembly is Figure 6-4. The reference designation prefix for the entire assembly is A4.

2.1.1 Type 8121 IF Amplifier. - The IF Amplifier used in the signal monitor carries the reference designation prefix A1; its schematic diagram is Figure 6-6. The IF amplifier is composed of three etched-circuit boards. Board No. 1 mounts the shaping amplifiers, first mixer, and sweep oscillator. Figure 6-7 is the schematic diagram for this board; its reference designation prefix is A1A1. Board No. 2 contains the crystal oscillator, second mixer and associated amplifiers, and the push-pull detector. The schematic diagram for this board is Figure 6-8; its reference designation prefix is A1A2. The 10-MHz marker oscillator is contained on the third etched circuit board. Its reference designation prefix is A1A3. The schematic for this circuit is shown on Figure 6-6.

2.11.1.1 Shaping Amplifiers. - (Refer to Figure 6-7) The 10-MHz output signal from the impedance-matching network in the receiver's IF strip is fed through dc-blocking capacitor C1 to the base of Q1, the first of two 10-MHz

shaping amplifiers. Resistor R1 terminates the input. The signal from the collector of Q1 is fed through a double-tuned, over-coupled network to the base of the second shaping amplifier Q2. An out-of-phase signal voltage is provided at the junction of C5 and L1 that is fed back to the base of Q1 through capacitor C2 to neutralize the stage. This same method of neutralization is used for Q2. Resistors R5 and R11 in the collectors of Q1 and Q2, respectively, are parasitic suppressors. The bandwidth of the response produced by the two shaping amplifiers, when combined with that of the mixer output in the RF tuner, is a flat, 300-kHz wide response. A high-impedance detector is included in the collector circuit of Q2 to provide a signal voltage at test point TP1 that can be viewed on an oscilloscope and used as an aid during alignment of the interstage network. The output from Q2 is fed through the second double-tuned network to the source of the first mixer, Q3.

2.11.1.2 Sweep Oscillator.- The sweep oscillator, Q4 is basically a Clapp circuit that has its output frequency swept across a maximum range of 300 kHz. The oscillator has a nominal center frequency of 12 MHz. The sweeping action is controlled by CR2, a voltage-variable capacitor (Varicap). The capacitance of this semiconductor varies inversely with the reverse bias applied across it. The bias voltage is obtained from CENTER FREQ potentiometer R3. Rotation of this control in the clockwise direction increases the reverse bias and decreases the capacitance of the Varicap. Counterclockwise rotation decreases the bias and increases the capacitance. The Varicap is connected in series with the sweep oscillator tank circuit and controls the center frequency by varying the tank circuit capacitance. The voltage applied to the anode of the Varicap has a modified sawtooth waveform. This voltage is obtained from the sweep generator and horizontal amplifier board, A2. It is passed through a sawtooth shaping network prior to its application to CR2. The shaping network distorts the linear sawtooth waveform to compensate for the non-linear changes in capacity of the Varicap with respect to the applied voltage. Thus, the sawtooth voltage changes at a non-linear rate resulting in a sweep oscillator frequency that varies at a linear rate. The output of the sweep oscillator is taken at the base of Q4 and coupled to the gate of the first mixer through C18.

2.11.1.3 First Mixer and 2-MHz IF Amplifier.- The first mixer, Q3, beats the input signal from the shaping amplifiers with the sweep oscillator signal to produce the 2-MHz first IF frequency. The mixer utilizes a type 3N128 MOS FET. A FET is used as the mixer to minimize the generation of spurious signals in the mixing process. The IF signal is applied to the source element and the sweep oscillator signal is applied to the gate. The 2-MHz first IF frequency is taken from the drain and fed through a double-tuned, over-coupled network to the base of the 2-MHz IF amplifier, A2Q1 (See Figure 6-7). The output from A2Q1 is coupled through a second double-tuned network to the base of the second mixer, A2Q2.

2.11.1.4 2.205-MHz Oscillator.- Transistor A2Q5 operates in a crystal-controlled Colpitts configuration at a frequency of 2.205 MHz. The operating frequency is determined by crystal A1Y1 which is mounted on top of the brass chassis. Regenerative feedback is taken at the junction of capacitors A2C30 and A2C31 and fed to the emitter through A2R34. The output signal is taken from the emitter and fed through A2C28 to the second mixer.

2.11.1.5 Second Mixer.- The second mixer, A2Q2, receives the 2-MHz IF signal and the 2.205-MHz oscillator signal on its base. The mixer heterodynes these signals to produce the 205-kHz second IF frequency, which is taken at the collector. This second IF frequency is fed to the base of the first 205-kHz IF amplifier.

2.11.1.6 205-kHz IF Amplifier.- The input to the first 205-kHz IF amplifier, A2Q3, is from a capacitive impedance-matching network consisting of A2C11 and A2C12. Potentiometer A2R11 sets the gain of the stage by varying the amount of forward bias applied to the base. This control is set at the factory to produce a one-inch vertical deflection when a 10-μV signal is appled to the signal monitor input (A4P1). The output from A2Q3 is fed through a second double-tuned circuit to the base of A2Q4. The selectivity necessary for good resolution is provided by the 2-kHz bandwidth response at the input to A2Q4. The signal from the collector of this stage is fed through a single-tuned circuit to the input of the push-pull detector circuit.

2.11.1.7 Push-Pull Detector.- The push-pull detector circuit, consisting of diodes A2CR1 through A2CR4, produces two outputs of equal amplitude but of opposite polarity. The positive output is taken from A2CR3 and A2R27 and fed to one deflection plate in the CRT; the negative output is taken from A2CR4 and A2R29 and fed to the other deflection plate. The diodes are connected as half-wave voltage doublers to obtain the required output. Since the two circuits are basically similar, only the network associated with the positive output will be discussed. During the negative-going half cycle of the input signal, diode A2CR1 is forward biased and capacitor A2C22 charges to the peak value of the applied voltage less the drop across the diode. The current flow through A2C22 results in a voltage at the junction of the two diodes that is more positive than the voltage at the opposite end. During the positive-

going half cycle, diode A2CR3 is forward biased permitting capacitor A2C27 to charge to the peak voltage less the drop across A2CR3. However, since A2C22 is already charged to approximately the peak of the applied voltage, and since it is in series with the input, its charge is added to that across A2C27. Thus, the charge across A2C27 is twice the peak applied voltage. An offset voltage, supplied from the resistive divider made up of A2R24, A2R25, and A2R28 is also applied across A2C27 which results in a dc voltage at the output of approximately 80 volts. The offset voltage applied to the negative doubler circuit is obtained from the arm of the vertical position potentiometer, A2R25. This permits the trace to be positioned near the bottom of the CRT screen. The offset voltage at this point is variable from approximately 72 to 88 volts.

2.11.1.8 Marker Oscillator.-(Refer to Figure 6-5.) The marker oscillator, A3Q1, provides a reference pip on the CRT trace to indicate the center of the signal monitor bandpass. The marker oscillator is contained in a shielded module mounted on the IF amplifier chassis. It is crystal controlled and operates at 10 MHz. Potentiometer A2R48 is used to set the amplitude of the marker pip by varying the supply voltage to A3Q1. The output from A3Q1 is fed through A3C2, and A3E1, to the source element of the first mixer, A1Q3.

2.11.2 Type 8229 Sweep Generator and Horizontal Amplifier.-The schematic diagram for this subassembly is Figure 6-9; its reference designation prefix is A2.

2.11.2.1 Sawtooth Generator.-The sawtooth waveform which is used to control the horizontal CRT trace and the sweep oscillator frequency is provided by the sawtooth generator, Q1, a unijunction transistor. Capacitor C1 charges from the +24-volt supply through constant current generator Q2. This configuration is used to obtain maximum linearity of the sawtooth. The charging action of C1 produces the leading edge of the sawtooth waveform. When the charge across the capacitor reaches sufficient potential, the emitter-base one junction of Q1 becomes forward biased, and the stage conducts. Capacitor C1 then discharges rapidly through the transistor to ground, creating the trailing edge of the waveform. The peak voltage developed across C1, and thus the amplitude of the waveform, is determined by the resistive voltage divider consisting of R1 through R3. The adjustment of the divider network is made during initial alignment and calibration of the signal monitor to compensate for differences in electrical characteristics between unijunction transistors. The sawtooth waveform at the collector of Q2 is fed through emitter follower Q3 to the horizontal width and sweep calibration controls.

2.11.2.2 DC Amplifier.-The sawtooth wavetrain is fed to the base of Q11 from the arm of the sweep calibration potentiometer R22. The collector of Q11 is connected to Q12 in a complementary configuration. These two stages operate as a voltage amplifier to provide the gain necessary to operate the sweep oscillator. The amplified output is coupled through capacitor C3 to the SWEEPWIDTH kHz potentiometer, A1R6. This control applies the signal to the sawtooth shaping network.

2.11.2.3 Horizontal Output Amplifier.-The sawtooth wavetrain from Q3 is fed to the horizontal width control, R12. This control varies the amplitude of the sawtooth input signal to the horizontal output amplifier to provide a means of adjusting the width of the sweep trace so that it extends across the entire face of the CRT. Transistors Q8 and Q13 form a differential amplifier which directly drives the horizontal CRT deflection plates. High-voltage transistors are used for this circuit to provide sufficient output voltage to deflect the electron beam across the face of the CRT without using a step-up transformer. Transistors Q9 and Q10 provide ac and dc coupling, respectively, between the two stages of the differential amplifier. This circuit arrangement makes it possible to vary the horizontal position control, R33, without changing the gain of the differential amplifier. Both Q9 and Q10 are connected as emitter followers. The sawtooth input to the amplifier is fed through Q5 which functions as a low-impedance source driver. The sawtooth developed across load resistor R19 is directly coupled to both Q8 and Q9. During the positive-going ramp of the sawtooth Q8 conducts harder, causing a drop in the voltage developed across load resistor R20. Simultaneously, the sawtooth output from Q9 is fed through R24 to the emitter of Q13. Since the base of this transistor is held at a fixed potential, the positive-going voltage applied to the emitter drives it toward cut off. As a result, the collector voltage swings in the positive direction toward the +200-volt source. Since the CRT horizontal deflection plates are connected directly to the collectors of Q8 and Q13, the electron beam is attracted across the face of the CRT toward the deflection plate connected to Q13. Retrace of the beam occurs on the trailing edge of the sawtooth when the input voltage suddenly drops. The collector voltage of Q8 rises rapidly and that of Q13 drops as this transistor now conducts heavily. The resulting change in potential on the horizontal deflection plates returns the electron beam to the opposite side of the screen. By adjusting R33 the horizontal position of the sweep trace can be changed. This control determines the quiescent current through Q8 and Q13, and thus the no-signal voltage on the deflection plates. Assuming R33 is rotated in the clockwise direction, the voltage on the bases of Q10 and Q13 goes more pos-

itive, causing both transistors to conduct harder. This causes the collector voltage of Q13 to decrease, and the emitter voltage of Q10 to increase in the positive direction. The voltage increase is fed through R25 to the emitter of Q8 so that the conduction of the transistor decreases, resulting in an increase in collector voltage. The sweep trace will now shift in the direction of the deflection plate attached to Q8. If R33 is rotated in the counterclockwise direction, the effect will be opposite, with the sweep trace shifting in the direction of the deflection plate attached to Q13. Resistors R35, R36, and R37 form a current divider which maintains the emitter to base ac impedance of Q13 constant as R33 is varied, thus holding the gain of the transistor constant regardless of the position of the horizontal position control.

2.11.3 Power Supply.- The low voltages required by the signal monitor are provided by the 521A Receiver power supply. The high voltage required by the CRT, and its associated circuits, is provided by high voltage supply, PS1. It is a dc-to-dc converter contained in a sealed module mounted on the signal monitor chassis. The input voltage is +24 Vdc and the output voltage is approximately -1500 volts.

2.11.4 Cathode Ray Tube.- The CRT, V1, provides a visual display of the input signal spectrum. The CRT has a rectangular face with a green plexiglass overlay which is inscribed with a horizontal base line, a vertical center marker, and five smaller vertical markers on each side of the center. These markers are not calibrated in any specific units but are supplied for reference purposes only. The -1500 volt output from power supply PS1 is applied to the control grid of the tube and to a voltage divider consisting of resistors A3R1 through A3R6. The voltage divider provides reduced voltage outputs for the various CRT operating functions. The intensity of the light beam on the face of the CRT is adjusted by the INTENSITY control, A3R2, which varies the accelerator voltage applied to the cathode. The FOCUS control, A3R4, is utilized to obtain a sharp waveform on the CRT screen by varying the potential on the focusing element. The FOCUS and INTENSITY controls are mounted on the front panel.

SECTION III

INSTALLATION AND OPERATION

3.1 INSTALLATION

The 521A receiver is designed for mounting in a standard 19-inch rack. The unit will occupy 3.5 inches of vertical space and extend approximately 16 inches back into the rack. If used in a mobile installation, some means should be devised to support the sides and/or rear of the equipment. A brace extending along the sides from the front panel to the rear apron is preferred. Do not rely soley on the front-panel mounting hardware to support the unit.

3.1.1 Power Connection. - Rotate the AUDIO GAIN control fully counterclockwise to the PWR OFF position. Plug the power cord into a 115 or 230 Vac source. The third pin of the power plug grounds the unit. If a three pin receptacle is not available use a three-to-two pin adapter provided. Be sure to attach the wire to a suitable ground. Before energizing the receiver, check the rear-apron input power selector switch, S6, to make sure it is in the proper position for the line voltage being used.

3.1.2 Antenna Connection. - Connect the antenna to RF INPUT jack J1 on the rear apron. This jack is a type-BNC connector.

3.1.3 AFC Input Connection. - Connect the AFC output from the associated electronic frequency counter, if used, to AFC INPUT jack J3. This jack is also a type-BNC connector.

3.1.4 LO Output. - The local oscillator signal is available at the rear-apron, BNC-type jack, marked J2 LO OUTPUT.

3.1.5 IF Output. - The 10-MHz IF signal is available at rear-apron IF OUTPUT jack J4, a type-BNC connector.

3.1.6 Audio Output. - The 600-ohm audio output signal is available at terminals 1 and 2 of TB1 on the rear apron, and at the PHONES jack on the front panel.

3.1.7 Video Output. - The video signal is availabe at the VIDEO OUTPUT jack, J5, on the rear apron. This jack is a type-BNC connector.

3.1.8 COR Output. - The carrier operated relay contacts are available at terminals 5 through7 of TB1. A normally-closed condition exists between terminals 5 and 6, and a normally-open condition appears between terminals 6 and 7.

3.1.9 IF AGC Output. - The IF AGC signal may be monitored at terminal 4 of TB1.

3.2 OPERATION

The controls and indicators found on the front panel of the Type 521A Receiver are described in the following paragraphs. These controls and indicators are shown in Figure 5-1.

3.2.1 Audio Gain Control and Power ON-OFF Switch. - The AUDIO GAIN control varies the amplitude of the audio signal present at the rear-apron terminal board and front-panel PHONES jack. This control also turns the power on when rotated clockwise from its extreme counterclockwise PWR OFF position.

3.2.2 RF Gain Control. - The gain of the receiver is controlled by the RF GAIN potentiometer when the AM MAN or CW modes are selected.

3.2.3 External AFC Switch. - Placing the EXT AFC switch in the ON position results in the application of a correction voltage to the local oscillator in the RF tuner to prevent the receiver drifting from a desired frequency. This correction voltage must be supplied by an optional, external electronic frequency counter.

3.2.4 BFO Tuning Control. - The BFO TUNING control is used to vary the pitch of the CW-audio signal when the CW

mode of operation is selected. Set the control to midrange when tuning; once the desired signal is located the pitch can be adjusted as desired.

3.2.5 Function Switch. - Set the function switch in the FM, AM AGC, AM MAN, or CW position as desired, before the receiver is tuned. When the AM MAN or CW modes are selected, the gain of the receiver is controlled by the RF GAIN potentiometer. The receiver gain is controlled by internal circuitry when the AM AGC or FM modes are selected.

3.2.6 COR Sensitivity Control. - The COR SENSITIVITY control is used to obtain COR operation at the desired signal level. Clockwise rotation of the control increases the sensitivity.

3.2.7 COR Delay Switch. - The COR DELAY switch controls the length of time the COR function remains in operation after the activating signal disappears. In the FAST mode, the COR function remains on for approximately 0.5 seconds; in the SLOW position, the delay is approximately 6 seconds. The COR lamp mounted between the delay switch and the sensitivity control will illuminate when the COR circuit is activated.

3.2.8 IF Bandwidth Switch. - The IF BANDWIDTH kHz switch sets the bandwidth of the IF strip at 4 kHz, 10 kHz, or 50 kHz. When searching for a signal, it is advisable to use the widest bandwidth.

3.2.9 Video Gain Control. - The VIDEO GAIN control varies the amplitude of the video signal present at jack J5.

3.2.10 Intensity Control. The brilliance of the trace on the CRT screen may be varied by the INTENSITY control.

3.2.11 Focus Control. - The FOCUS control provides a means of obtaining a sharp trace on the face of the CRT.

3.2.12 SM Gain Control. - The SM (signal monitor) GAIN control varies the height of the pips displayed on the CRT.

3.2.13 Center Frequency Control. - The CENTER FREQ control changes the horizontal position of the signal pips on the CRT screen. During normal operation, use this control to center the frequency spectrum being displayed under the center mark on the screen.

3.2.14 Sweep Width Control. - The SWEEP WIDTH kHz control varies the width of the frequency spectrum being viewed. When this control is in the maximum clockwise position, a maximum bandwidth of 300 kHz is being displayed.

3.2.15 Marker Switch. - Placing the MARKER toggle switch in the ON position results in the appearance of a pip on the CRT screen at 10 MHz. This pip indicates the center of the signal monitor response as well as the center of the receiver's IF bandpass.

3.3 INTERPRETATION OF SIGNALS

The following list is presented as a guide for interpretation of various signals and waveforms that might appear on the CRT.

(1) An unmodulated carrier without noise or random distrubances will appear as a deflection with fixed height.

(2) A carrier that is amplitude modulated will appear as a deflection of variable height. If the modulation rate is high, sidebands may appear.

(3) A single-tone-modulated FM signal will appear as a group of spikes corresponding to the center frequency and the sidebands.

(4) Noise appears as varying irregularities or "grass" along the base line and may be eliminated by a reduction of the SM GAIN control setting.

SECTION IV

MAINTENANCE

4.1 GENERAL

The Type 521A Receiver is conservatively designed to give trouble-free operation. The receiver presents no special maintenance problems and normally requires no care beyond being kept clean. Down time will be minimized, should trouble occur, if the maintenance technician is familiar with Section II of this manual in which the circuits are described before beginning the troubleshooting. Field maintenance should be confined to cleaning and the replacement of fuses and plug-in modules. All other maintenance should be carried out in a well-equipped shop and performed by experienced personnel.

4.2 PLUG-IN MODULES

The plug-in modules can be easily removed by simply pulling them upward from the receptacles into which they are fitted. The numbers on the main chassis adjacent to the receptacle pins correspond to the numbers indicated on the schematic digrams at the points where the connecting leads pass through the lines outlining each module. Modules having different functions are keyed to prevent them from being damaged as a result of being placed in the wrong receptacle. All plug-in modules have their type numbers etched on the back of the cards. By referring to the schematic diagrams their reference designation prefixes can be found, and thus their proper location in the unit.

4.3 TROUBLESHOOTING

Intitial troubleshooting should be directed toward localizing the trouble to a specific section of the receiver. In the case of the plug-in modules, a quick check can be made by plugging in a spare module known to be good. If these substitutions do not cure the trouble, then the audio, video, COR, and AGC amplifiers, and the +24, -12, and +18 Vdc power supplies can be eliminated from consideration. This leaves a series chain consisting of subassemblies A1 and A3 as primary suspects in the AM and CW modes; and A1, A3, and A2 in the FM mode. To check out the chain feed a signal within the receiver's tuning range into the antenna input, tune the receiver to the frequency, and trace the signal through the subassemblies using a wideband oscilloscope. A simple method of troubleshooting the signal monitor IF amplifier circuits is to feed in a 10-MHz CW signal at plug A4P1, and check for an output at the various test points provided, using an oscilloscope. Voltage and resistance measurements of the sweep generator and horizontal amplifier circuits will usually pin point a malfunctioning stage. Once the faulty stage is determined in the receiver section, voltage and resistance measurements will generally locate the defective component. Typical transistor and module pin voltages for the receiver section are given in Table 4-1. Typical tube and transistor element voltages for the signal monitor are listed in Table 4-2.

4.4 MAINTENANCE OF GEAR TRAIN ASSEMBLY

Figure 5-11 is an exploded view of the gear train assembly used in the receiver. The assembly relies on stops built into the inductuner to halt rotation at the high and low-frequency ends of the tuning range. The gear train is designed so that routine maintenance is not required. The occasional application of a few drops of light oil to the shaft bearings and removal of any accumulated dust is all that is necessary to assure proper operation.

4.4.1 Dial Lamp Replacement. - To replace a burned out dial lamp proceed as follows:

(1) Remove the two black screws that hold the dial escutcheon. Remove the escutcheon.

(2) Remove the light bar (no. 5 on Figure 5-11) by first removing the two small retaining screws.

(3) Gently pull the light bar and printed circuit light board from the gear train.

(4) Rotate the light board up and detach it from the light bar by removing the two screws, (no. 42 on Figure 5-11.)

(5) Unsolder burned out lamp and replace with a new unit.

(6) Replace light board and light bar by reversing steps (1) through (4) above.

4.4.2 Alignment of Dial Tape. - A calibrated steel tape is used as the tuning dial. It is geared to the inductuner in such a manner that it is unlikely that it will ever get out of position. However, to check the alignment or to mechanically realign the dial, follow the steps given below:

(1) Turn tuning knob counterclockwise until rotation stops.

(2) The mark to the right of the arrow should line up with the dial pointer. If not proceed with the next step.

(3) Loosen set screw, no. 36 on the drum drive, item no. 14 on Figure 5-11.

(4) By hand, move the dial tape, independent of the gear train, to align the reference mark with the pointer. Tighten the setscrew.

(5) Perform the dial calibration procedures described in paragraph 4.7.1.

4.5 ALIGNMENT PROCEDURES

4.5.1 General. - The alignment procedures given here are suitable when making periodic performance checks, or when making adjustments after replacing transistors or components. Only those controls specifically referred to within a series of steps given for aligning a particular circuit affect the alignment of that circuit. Those controls not mentioned in any one series of steps may be left in any position. The alignment of this receiver should be performed only with suitable equipments by technicians thoroughly familiar with the receiver. If the limits and tolerances specified in the following procedures cannot be obtained, then a factory alignment is necessary.

4.5.2 Test Equipment Required. - The following equipments or their equivalents are required to perform the complete receiver alignment:

(1) Sweep Generator, Telonic Type SM-2000 with internal 10-MHz Marker

(2) Sweep Generator Plug-In Heads, Telonic Types LH-2 and VR-2M

(3) Signal Generator, Hewlett Packard, Type 608C

(4) Signal Generator, Hewlett Packard, Type 606A

(5) Electronic Frequency Counter, Hewlett Packard Type 5245L

(6) Detector, 50-ohm, Telonic Type XD-3A

(7) Oscilloscope, Tektronix Type 503

(8) Assorted cables, connectors, and alignment tools.

4.6 4/10/50-kHz BANDWIDTH IF AMPLIFIER ALIGNMENT

4.6.1 50-kHz IF Alignment. - Proceed as follows:

(1) Place the IF BANDWIDTH kHz switch in the 50 position; set the function switch to AM MAN and rotate the RF GAIN control fully clockwise

(2) Connect equipment as shown in Figure 4-1.

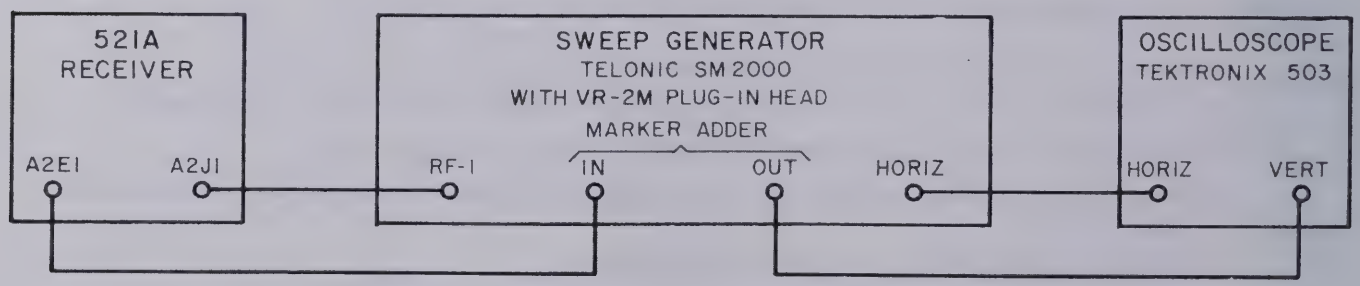


Figure 4-1. Equipment Setup, 4/10/50-kHz Bandwidth IF Amplifier

(3) Set the sweep generator output frequency to 10 MHz. Turn internal 10-MHz marker on.

(4) Adjust oscilloscope and sweep generator controls to display a response curve.

(5) Adjust inductors A3L4 and A3L3 from the bottom of the chassis, and A3L2, and A3L1 from the top, for a maximum amplitude, symmetrical response centered about the 10-MHz marker. A typical response is shown in Figure 4-2.

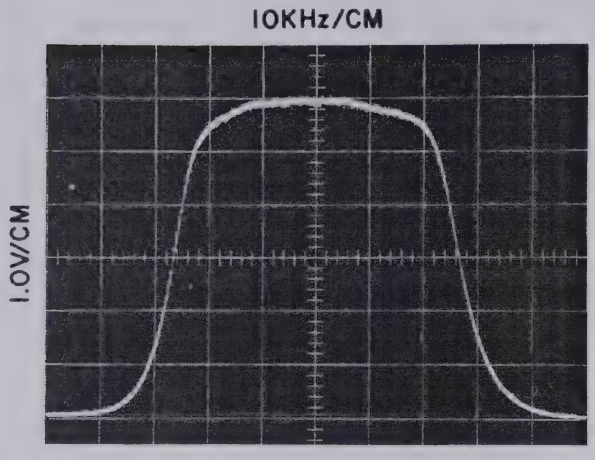


Figure 4-2. Typical Response Curve, 50-kHz Bandwidth IF Amplifier Alignment

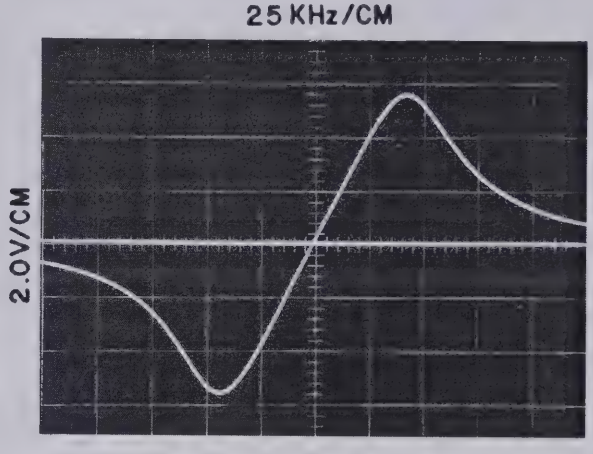


Figure 4-3. Typical Response Curve, FM Discriminator Alignment

4.6.2 4-kHz and 10-kHz Bandwidth IF Alignment. - The 4- and 10-kHz bandwidth paths in the IF amplifier are fixed tuned and need no adjustment. Figures 4-4 and 4-5 are typical response curves for these two bandwidths, and are included for references purposes.

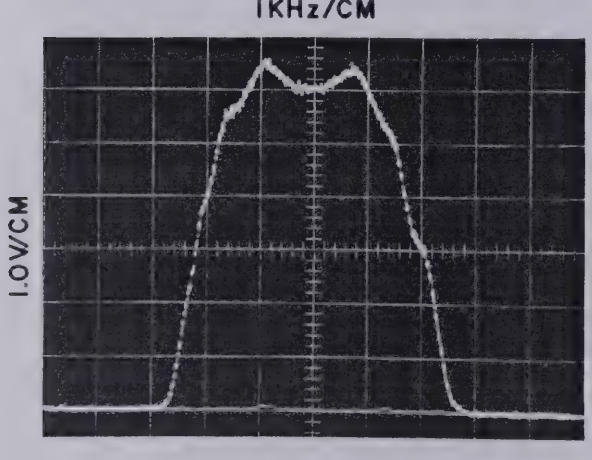


Figure 4-4. Typical Response Curve, 4-kHz Bandwidth IF Amplifier

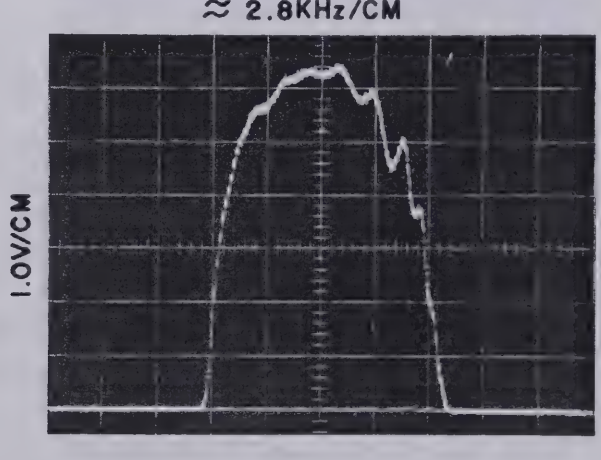


Figure 4-5. Typical Response Curve, 10-kHz Bandwidth IF Amplifier

4.6.3 FM Discriminator Alignment. - Proceed as follows:

(1) Connect equipment as shown in Figure 4-6.

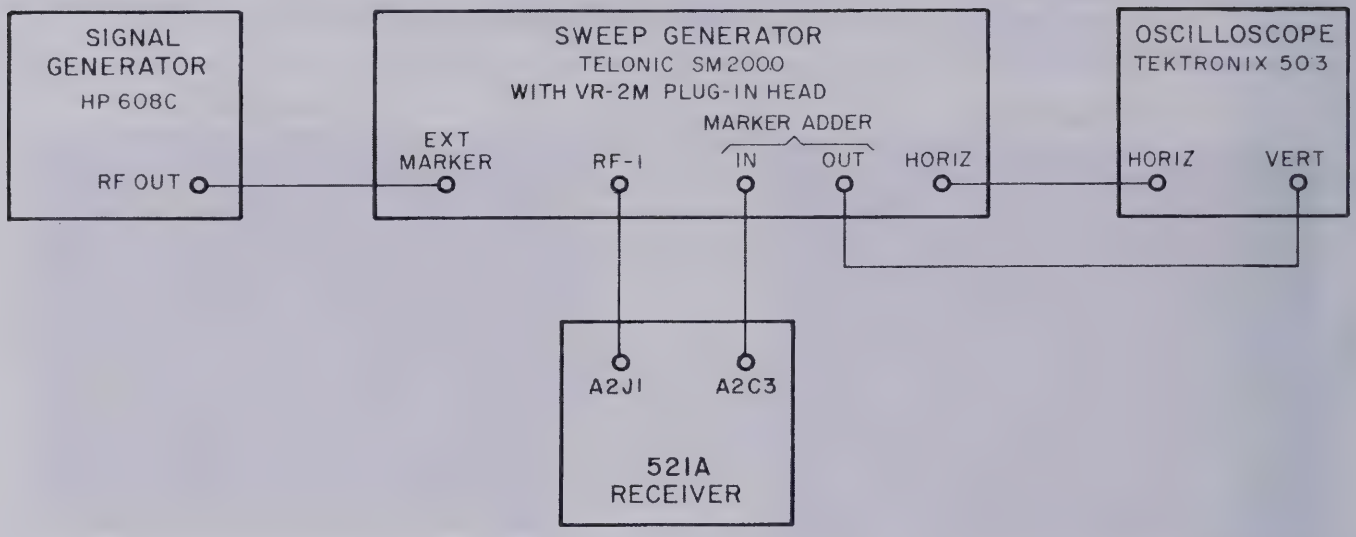


Figure 4-6. Equipment Setup, FM Discriminator Alignment

(2) Place receiver function switch in FM position.

(3) Set output frequency of sweep generator to 455 kHz.

(4) Set output frequency of signal generator to 455 kHz, CW mode.

(5) Adjust sweep generator and oscilloscope controls to display an "S" response curve.

(6) Adjust A2A1L3 for amplitude symmetry and A2A1T1 for zero crossing of the "S" curve about the 455 kHz marker. A typical response is shown in Figure 4-3.

4.7 20-70-MHz RF TUNER ALIGNMENT

The alignment of the RF tuner should be performed only if considered absolutely necessary, as the physical placement of components on the etched circuit boards is extremely critical. The alignment procedures given below should be performed after the replacement of a variable component (such as an end-inductor or variable capacitor) in the input, interstage, or oscillator circuits. A check of the RF bandwidth is desirable after the replacement of the mixer transistor. The tape dial should be re-calibrated if the oscillator transistor is replaced.

4.7.1 Dial Calibration. - Proceed as follows:

(1) Connect the output of the HP608C signal generator to RF INPUT jack J1; set output frequency to 20 MHz, CW mode (calibrated).

(2) Set receiver function switch to AM AGC.

(3) Tune the receiver to the signal generator frequency using the TUNING meter to indicate the proper setting.

(4) The dial should indicate 20 MHz, ±1%. If not adjust A1A1A3C6.

(5) Check the dial indications at 45 MHz and 70 MHz. If any of the dial readings exceed the ±1% tolerance readjust A1A1A3C6 slightly. After any adjustment of A1A1A3C6 at the two higher frequencies, recheck the dial at the low end.

(6) Repeat steps (1) through (5) until the dial readings are within the ±1% tolerance

4.7.2 Mixer Output Alignment. - Proceed as follows:

(1) Connect equipment as shown in Figure 4-7.

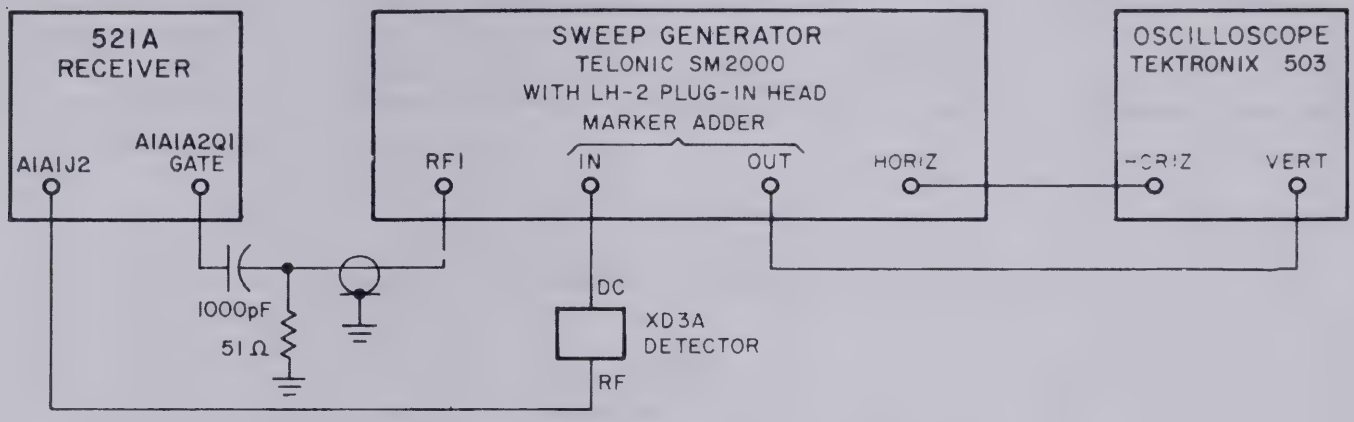


Figure 4-7. Equipment Setup, Mixer Output Alignment

(2) Set output frequency of sweep generator to 10 MHz; turn internal 10-MHz marker on.

(3) Adjust sweep generator and oscilloscope controls to display a response curve.

(4) Adjust A1A1L2 for a miximum amplitude, peaked response centered about the 10-MHz marker. A typical response is shown in Figure 4-8.

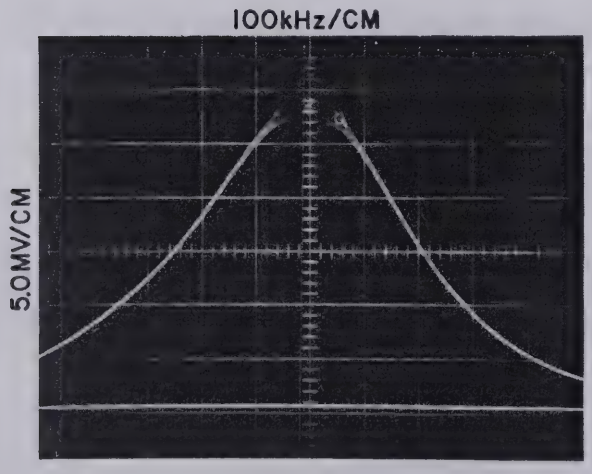


Figure 4-8. Typical Response Curve, Mixer Output Alignment

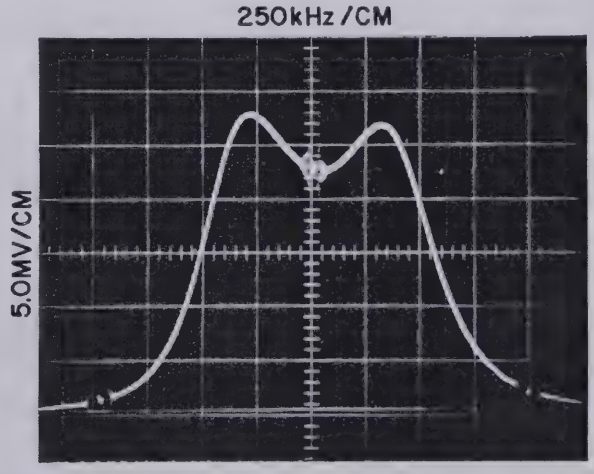


Figure 4-9. Typical Response Curve, 20-70-MHz RF Tuner Alignment (67 MHz)

4.7.3 RF Interstage Alignment. - Proceed as follows:

(1) Place receiver function switch in AM MAN position and rotate RF GAIN control fully clockwise.

(2) Connect equipment as shown in Figure 4-10.

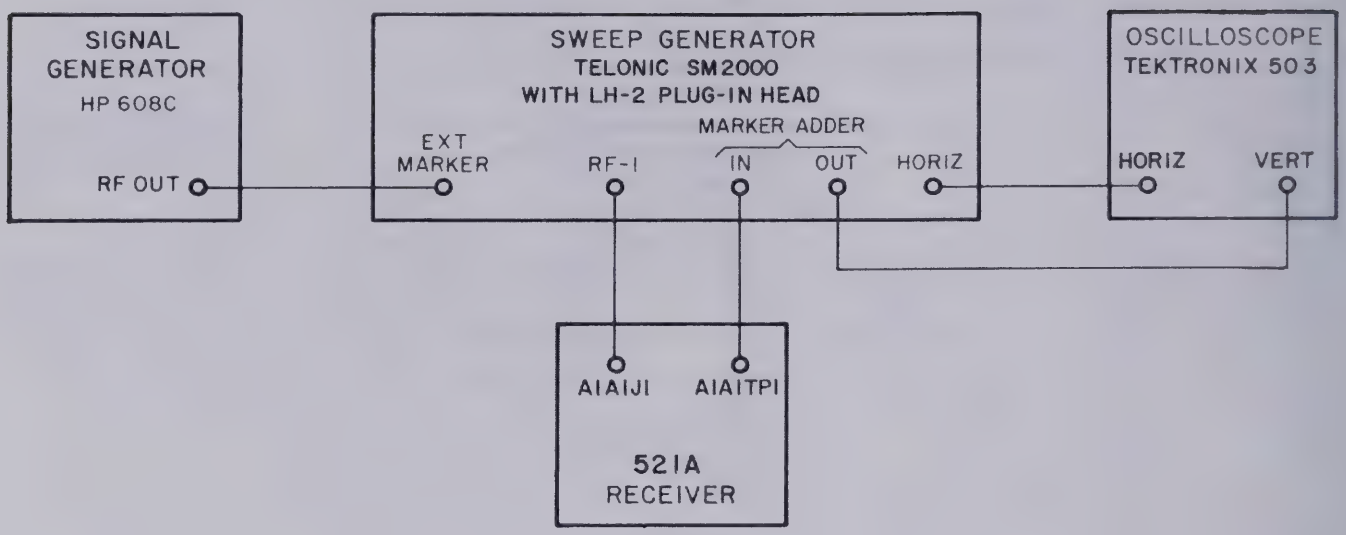


Figure 4-10. Equipment Setup, 20-70 MHz RF Tuner Interstage Alignment

(3) Set output frequency of sweep generator and signal generator to 67 MHz.

(4) Tune receiver to 67 MHz.

(5) Adjust sweep generator and oscilloscope controls to display a response curve.

(6) Adjust A1A1A1C3, A1A1A2C2, and A1A1A2C9 for a maximum amplitude, symmetrical response. The 67-MHz marker should appear in the center of the response. A typical response at 67 MHz is shown in Figure 4-9.

(7) Check the response at 20 MHz and 70 MHz. The response shape will vary but the marker should remain on or between the peaks.

4.8 SIGNAL MONITOR ALIGNMENT

The alignment procedure for the signal monitor is given in the following paragraphs. Refer to the schematic diagrams, Figures 6-4 through 6-8 as necessary.

4.8.1 205-kHz IF Amplifier Alignment. - Proceed as follows:

(1) Remove the bottom cover from the signal monitor chassis.

(2) Connect equipment as shown in Figure 4-11. (Test point A4A1TP1 is located on the center partition of the chassis).

(3) Using the frequency counter, calibrate the signal generator for a 205.000-kHz, CW output.

(4) Adjust the signal generator output level to produce a slight vertical shift (positive) of the CRT trace.

(5) Adjust inductors A1A2L7, A1A2L6, A1A2L5, A1A2L4, and A1A2L3, in the order given, for maximum positive shift of the CRT trace. Reduce the signal generator output level as necessary to keep the CRT trace on the screen.

4.8.2 Sweep Oscillator Adjustment. - Proceed as follows:

(1) Rotate CENTER FREQ control to midrange and turn MARKER on.

(2) Rotate SWEEPWIDTH kHz control fully counterclockwise.

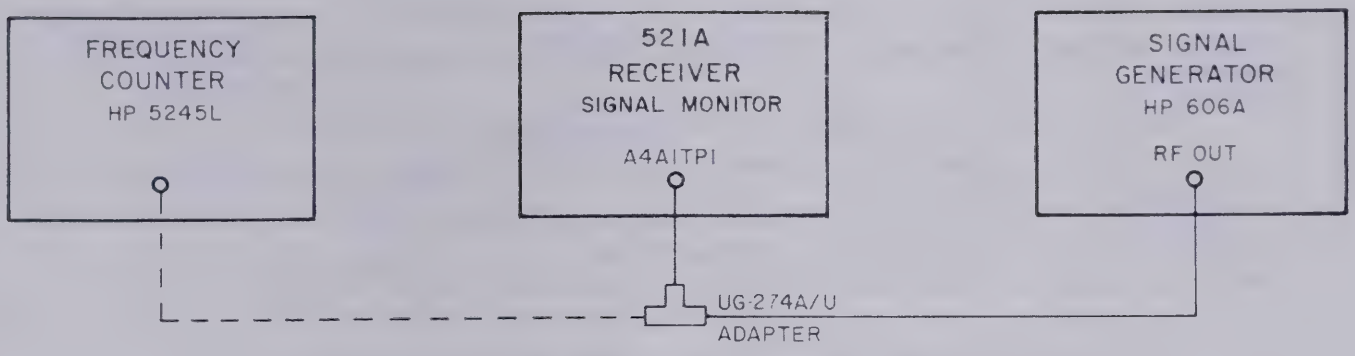


Figure 4-11. Equipment Setup, 205-kHz IF Amplifier Alignment

NOTE

To obtain a suitable marker it may be necessary to adjust the marker amplitude potentiometer, A2R48, located on the sweep generator and horizontal amplifier board.

(3) Carefully adjust inductor A1A1L9 for maximum positive shift of the CRT trace, and centering of the marker on the screen.

4.8.3 2-MHz IF Alignment. - Proceed as follows:

(1) Connect the output of the HP606A signal generator to A1A1TP1.

(2) Set output frequency of signal generator to 2-MHz, CW mode.

(3) Increase output level to produce a slight positive shift in the CRT base line.

(4) Adjust inductors A1A2L2, A1A2L1, A1A1L8, and A1A1L7, in the order given, for maximum positive shift of the CRT trace. Decrease the signal generator output level as necessary to keep the trace on the screen.

4.8.4 Input Shaping Network Alignment. - Proceed as follows:

(1) Connect equipment as shown in Figure 4-12.

(2) Set the output center frequency of the sweep generator to 10-MHz.

(3) Set the output frequency of the signal generator to 10 MHz, CW mode.

(4) Rotate the SM GAIN control fully clockwise.

(5) Adjust sweep generator and oscilloscope controls to display a response curve.

(6) Adjust inductors A1A1L6, A1A1L4, A1A1L3, and A1A1L1 for a maximum amplitude, symmetrical response centered about the 10-MHz marker. Use the signal generator to check for 3-dB response at 9.850 MHz and 10.150 MHz. A typical response is shown in Figure 4-13.

4.8.5 Horizontal Position, Horizontal Width and Sweep Calibration Adjustment. - Proceed as follows:

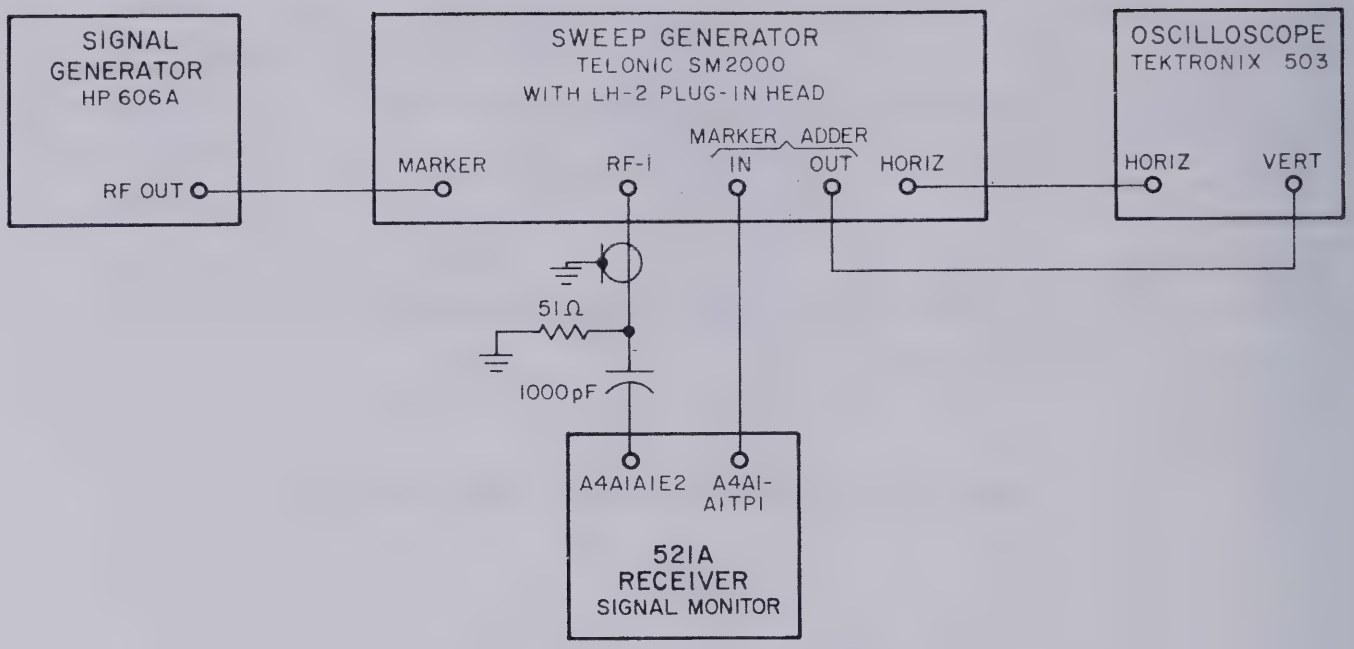


Figure 4-12. Equipment Setup, Input Shaping Network Alignment

(1) Rotate the SWEEP WIDTH kHz control fully clockwise.

(2) Using the frequency counter, calibrate the output frequency of the HP606A signal generator to 10.000 MHz.

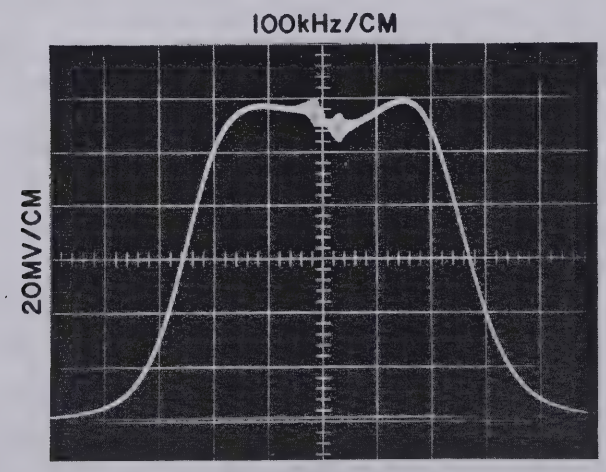


Figure 4-13. Typical Response, Input Shaping Network Alignment

(3) Disconnect the signal generator from the frequency counter and reconnect it to the signal monitor input, plug A4P1.

(4) Rotate the SM GAIN control fully clockwise, and set the CENTER FREQ control to midrange.

(5) Adjust the signal generator output level for full-scale deflection of the signal pip on the CRT screen.

(6) Adjust the horizontal position potentiometer, A4A2R33, to center the signal pip on the CRT screen.

(7) Observe the horizontal CRT trace. It should reach across the full width of the screen but at least one end should be barely visible. If not, adjust the horizontal width potentiometer, A4A2R12, until the trace appears as described. Repeat steps (1) through (6).

(8) Increase the frequency of the applied signal precisely 150 kHz. The signal pip should appear beneath the fifth vertical mark to the right of center. If not, adjust the sweep calibration potentiometer, A4A2R22, until it does.

(9) To check the setting, decrease the signal generator frequency exactly 300 kHz. The signal pip should appear near the fifth vertical mark to the left of center.

(10) Replace the bottom cover.

Table 4-1. Type 521A Receiver, Transistor and Module Pin Voltages

Ref. Desig.	Type	ELEMENT						
		Gate 1	Gate 2	Drain	Source	Emitter	Base	Collector
A1Q1	TA2644	1.0	3.7	15.5	1.5			
A1A2Q1	3N128	0.0		14.8	2.3			
A1A3Q1	2N3478					7.0	7.2	14.8
A1A3Q2	2N3478					9.4	10.0	17.0
A2A1Q1	2N4074					2.25	2.85	16.0
A2A1Q2	2N4074					2.40	2.80	11.6
A2A1Q3	2N4074					2.15	2.75	15.50
A2A1Q4	2N3478					2.00	2.75	16.0
A2A1Q5	2N3251					0.51	-0.06	-11.8
A3Q1	TA2644	0.98	3.09	16.73	1.85			
A3Q2	3N128	0.0		17.54	2.07			
A3Q3	2N3478					3.59	4.44	14.34
A3Q4	2N3478					5.04	5.63	13.46
A3Q5	2N4074					7.92	7.98	16.55
A3Q6	2N3478					2.15	2.86	15.73
A3Q7	2N3478					2.19	2.19	12.28
A3Q8	2N3478					2.08	2.08	10.86
A3Q9	2N3933					0.71	1.44	13.31
A3Q10	2N3933					0.72	1.44	13.31
A3Q11	2N3933					0.71	1.44	13.31
A3Q12	TA2644	1.10	3.12	10.80	1.45			
A3Q13	2N3251					16.09	15.41	1.92
A3Q14	2N3933					0.94	1.55	15.90
A3Q15	2N4074					0.08	0.65	18.00
A3Q16#	2N3933					0.88	1.61	15.18
A3Q17#	2N3933					2.11	2.82	14.20

Type 76118A -12V Regulated Power Supply (A5)

Pin Number	1	2	14	15	16
Voltage Reading	14.0 Vac	14.0 Vac	-11.8	0.0	0.0

Table 4-1. Type 521A Receiver, Transistor and Module Pin Voltages (Cont'd)

Type 76121A +24V Regulated Power Supply (A6)

Pin Number	3	4	13	15	16
Voltage Reading	28.0 Vac	28.0 Vac	23.5	0.0	0.0

Type 76124 +18V Regulated Power Supply (A7)

Pin Number	2	5	10
Voltage Reading	23.5	18.0	0.0

Type 7338 Video Amplifier (A8)

Pin Number	1	3	6	13	14
Voltage Reading	0.0	0.0	23.5	0.0	18.0

Type 7424 Audio Amplifier (A9)

Pin Number	1	3	7	10	11	12	13	14
Voltage Reading	0.0	0.0	23.0	0.0	0.0	0.0	0.0	0.0

Type 7509 Carrier Operated Relay (A10)

Pin Number	8	10	14	15	16
Voltage Reading	24.0	0.0	-12.0	0.0	0.0

Type 79316 AGC Amplifier (A11)

Pin Number	4	5	6	8*	9	10	11	13	14	15
Voltage Reading	0.0	-12.0	18.0	0.0	0.0	-12.0	0.0	0.0	0.0	0.0

TEST CONDITIONS: All readings are positive dc with respect to chassis unless otherwise noted. Readings taken with RCA-WV98B VTVM; 115 Vac applied to receiver; no signal input. Control Settings: Function switch in AM MAN; RF GAIN fully clockwise; IF BANDWIDTH kHz switch in position of bandwidth path under test.

NOTES: # Function switch in CW position.
* Function switch in AM AGC position.

Table 4-2. Type 79332 Signal Monitor, Tube and Transistor Element Voltages

Ref. Desig.	Type	Emitter	Base	Collector	Gate	Source	Drain
A4A1A1Q1	2N3478	2.0	2.7	15.5			
A4A1A1Q2	2N3478	2.0	2.8	16.0			
A4A1A1Q3	3N128				0.18	16.0	2.8
A4A1A1Q4	2N3478	5.6	5.8	9.6			
A4A1A2Q1	2N3478	0.4	1.0	17.7			
A4A1A2Q2	2N3478	1.4	2.1	17.0			
A4A1A2Q3	2N3478	1.5	2.1	17.0			
A4A1A2Q4	2N3933	0.8	1.5	18.0			
A4A1A2Q5	2N706	4.0	4.0	16.0			
A4A1A3Q1	2N706	0.0	-0.5	2.2			
A4A2Q1	2N2646	7.1	17.5 (B2)	0.0 (B1)			
A4A2Q2	2N3251	20.0	19.7	7.1			
A4A2Q3	2N929	6.7	7.1	24.0			
A4A2Q4			NOT USED				
A4A2Q5	2N929	6.7	7.1	24.0			
A4A2Q6			NOT USED				
A4A2Q7			NOT USED				
A4A2Q8	2N3440	6.2	6.7	98.0			
A4A2Q9	2N2270	6.0	6.7	24.0			
A4A2Q10	2N2270	6.0	6.5	24.0			
A4A2Q11	2N929	6.0	6.4	23.6			
A4A2Q12	2N3251	24.0	23.6	13.0			
A4A2Q13	2N3440	6.4	7.0	100.0			

Cathode Ray Tube A4V1

Pin Number	1	2	3	4	5	6	7	8
Voltage Reading	102.0	92.0	-1600 #	-1800 *	-1100	82.0	73.0	-1600 #

TEST CONDITIONS All readings are positive dc with respect to chassis unless otherwise noted. Readings taken with RCA-WV98B VTVM. 115 Vac applied, no signal input. Control settings: SWEEPWIDTH kHz, SM GAIN, fully clockwise; MARKER OFF.

NOTES: (B1) Base One; (B2) Base Two;
* Values range from -1500 to -1900 Vdc
# A4V1 pin 3 to pin 6 potential is 6.3 Vac (filament)

SECTION V

REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies (and modules), and parts. An example of the unit method follows:

Read from right to left as: First (1) resistor (R) of first (1) subassembly (A)

As shown on the main chassis schematic, components which are an integral part of the main chassis have no subassembly designation.

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on drawings and illustrations following the notation "REF DESIG PREFIX."

5.3 LIST OF MANUFACTURERS

Vendor Code	Name and Address	Vendor Code	Name and Address
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53204	04713	Motorola Semiconductor Prod., Inc. 5005 East McDowell Road Phoenix, Arizona 85008
01281	TRW Semiconductors, Inc. 14520 Aviation Blvd. Lawndale, California 90260	04941	Walsco Electronics Corp. 4 South Wyman Rockford, Illinois 61101
01351	Dynamic Gear Company, Inc. 173-177 Dixon Avenue Amityville, New York 11701	06961	Piezoelectric Division of Clevite Corp. 232 Forbes Road Bedford, Ohio
02114	Ferroxcube Corporation of America Mt. Marion Road Saugerties, New York 12477	07688	Joint Electron Device Engineering Council Washington, D. C.
02735	Radio Corporation of America Commercial Receving Tube and Semiconductor Division Somerville, New Jersey	14632	Communication Electronics, Inc. 6006 Executive Boulevard Rockville, Maryland 20852
04013	Taurus Corporation 1 Academy Hill Lambertville, New Jersey 08530	15605	Cutler-Hammer, Inc. 315 North 12th Street Milwaukee, Wisconsin 53233

Vendor Code	Name and Address
21604	Buckeye Stamping Company 555 Marion Road Columbus, Ohio 43207
26655	Oster Tool & Die Corporation 5234 W. 26th Street Cicero, Illinois 60650
37942	P. R. Mallory and Company, Inc. 3029 E. Washington Street Indianapolis, Indiana 46206
56289	Sprague Electric Company North Adams, Massachusetts 01247
71279	Cambridge Thermionic Corporation 430 Concord Avenue Cambridge, Massachusetts 02138
71400	Bussman Manufacturing Division of McGraw-Edison Co. 2538 W. University Street St. Louis, Missouri 63107
71450	CTS Corporation 1142 West Beardsley Avenue Elkhart, Indiana 46514
71590	Centralab, Division of Globe-Union, Inc. 932 E. Keefe Avenue Milwaukee, Wisconsin 53212
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640
71785	Cinch Manufacturing Company Howard B. Jones Division 1026 South Homan Avenue Chicago, Illinois 60624
72619	Dialight Corporation 60 Stewart Avenue Brooklyn, New York 11237
72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
74306	Piezo Crystal Company 265 East Pomfret Street Carlisle, Pennsylvania 17013
74868	Amphenol Corporation Amphenol RF Division 33 East Franklin Street Danbury, Connecticut 06810
75042	IRC Incorporated 401 North Broad Street Philadelphia, Pennsylvania 19108
75915	Littlefuse, Incorporated 800 E. Northwest Highway Des Plaines, Illinois 60016
76055	Mallory Controls, Division of P. R. Mallory and Co., Inc. State Road 28 W Frankfort, Indiana 46041
79136	Waldes Kohinoor Inc. 47-16 Austel Place Long Island City, New York 11101
80131	Electronic Industries Association 2001 Eye Street, N. W. Washington, D. C. 20006
80294	Bourns, Incorporated 6135 Magnolia Avenue Riverside, California 92506
81312	Winchester Electronics, Division of Litton Industries, Inc. Main Street, & Hillside Avenue Oakville, Connecticut 06779
81349	Military Specifications
82389	Switchcraft, Incorporated 5527 North Elston Avenue Chicago, Illinois 60630

Vendor Code	Name and Address
83086	New Hampshire Ball Bearings, Inc. Peterborough, New Hampshire 03458
84171	Arco Electronics, Inc. Community Drive Great Neck, New York 11022
88044	Aeronautical Standards Group Department of Navy and Air Force
91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
91506	Augat, Incorporated 33 Perry Avenue Attleboro, Massachusetts 02703
91662	Elco Corporation Maryland Rd. & Computer Avenue Willow Grove, Pennsylvania 19090
95121	Quality Components, Inc. P. O. Box 113 St. Mary's Pennsylvania 15857
96906	Military Standards Promulgated by Standardization Div. Directorate of Logistic Services DSA
97814	Sealtron Company Reading Road at Amity Cincinnati, Ohio
98927	Electronic Specialty Co. Electronics Division-Portland 18900 N. E. Sandy Blvd. Portland, Oregon 97220

5.4 PARTS LIST

When ordering replacement parts for CEI, specify the type and serial number of the equipment, and the reference designation and description of each part ordered. The Vendors and Vendor Part Numbers listed are included as a guide to the user of the equipment in the field and do not necessarily agree with the parts installed in the equipment. Except in those cases specifically noted, the replacement part may be obtained from any vendor as long as the physical and electrical parameters of the part selected agree with the original part.

NOTE

As improved semiconductors become available it is the policy of CEI to incorporate them in proprietary products. For this reason some transistors and diodes installed in an equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

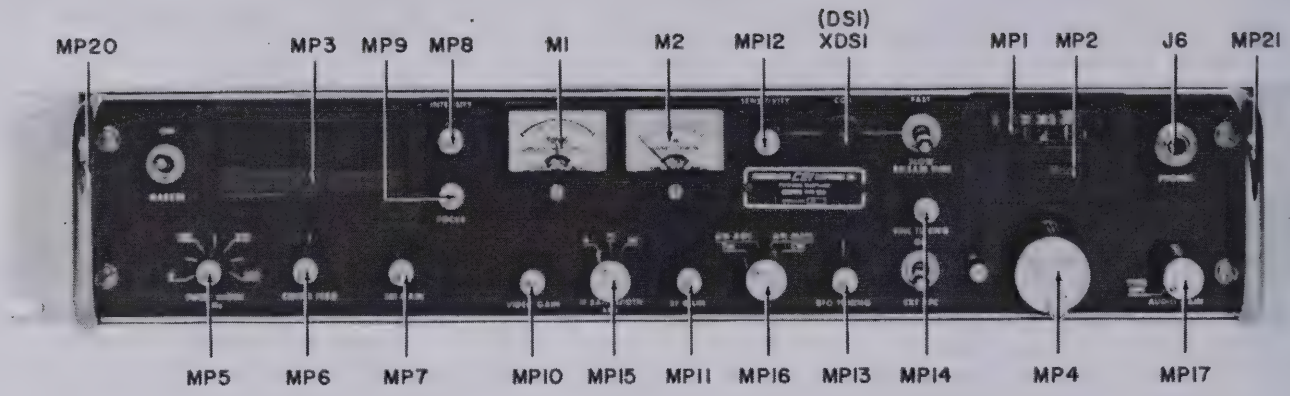


Figure 5-1. Location of Mechanical Parts, Type 521A Receiver Front Panel

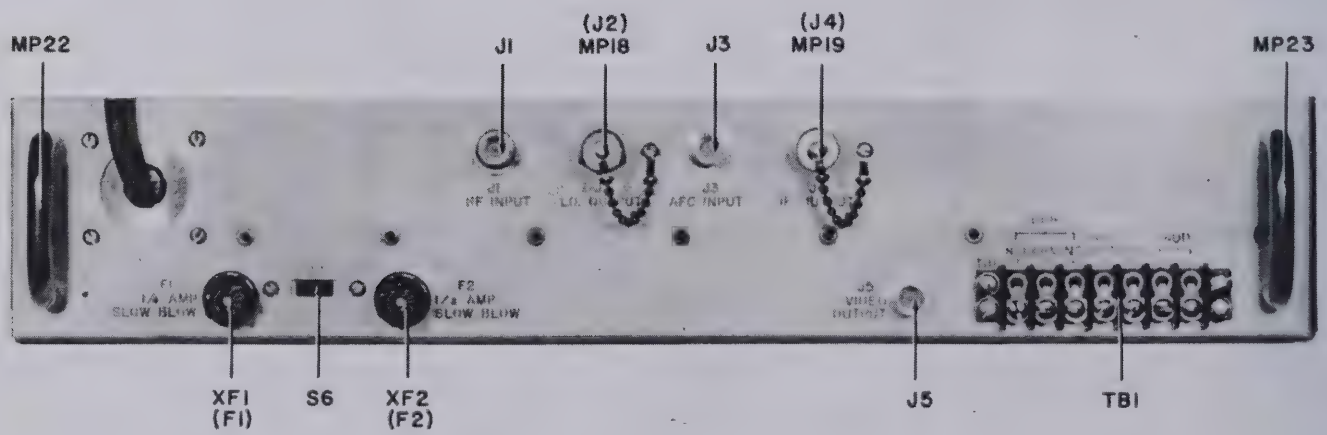


Figure 5-2. Location of Mechanical Parts, Type 521A Receiver Rear Apron

5.4.1 Type 521A Receiver, Main Chassis

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
A1	20-70 MHz RF TUNER ASSEMBLY	1	71207	14632
A2	FM LIMITER/DISCRIMINATOR	1	79331	14632
A3	IF AMPLIFIER	1	72186	14632
A4	SIGNAL MONITOR	1	79332	14632
A5	-12V REGULATED POWER SUPPLY	1	76118A	14632
A6	+24V REGULATED POWER SUPPLY	1	76121A	14632
A7	+18V REGULATED POWER SUPPLY	1	76123A	14632
A8	VIDEO AMPLIFIER	1	7338	14632
A9	AUDIO AMPLIFIER	1	7424	14632
A10	COR	1	7509	14632
A11	AGC AMPLIFIER	1	79316	14632
C1	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 50V	1	19C214A6	56289
DS1	LAMP, INCANDESCENT: 6V, 0.2A	1	328	07688
F1	FUSE, 3AG, Slow-Blow: 1/4A	1	MDL-1/4	71400
F2	FUSE, 3AG, Slow-Blow: 1/8A	1	MDL-1/8	71400
FL1	FILTER, RFI	1	JN33-694A	56289
J1	CONNECTOR, JACK, BNC SERIES, Part of W1	2	2475	74868
J2	Same as J1, Part of W2			
J3	CONNECTOR, JACK, BNC SERIES	2	17825	74868
J4	Same as J3, Part of W5			
J5	CONNECTOR, RECEPTACLE, BNC SERIES	1	UG-1094/U	81349
J6	CONNECTOR, PHONE JACK	1	L-11	82389
J7	CONNECTOR, RECEPTACLE, MULTIPIN	1	MRE-14SG7	81312
M1	METER TUNING	1	1633	14632
M2	METER, SIGNAL STRENGTH	1	14056	14632
MP1	WINDOW	1	11448-1	14632
MP2	WINDOW	1	11449-1	14632
MP3	FILTER	1	13278	14632
MP4	KNOB	1	11755-2	14632
MP5	KNOB	10	PS50D-1	21604
MP6	Same as MP5			
MP7	Same as MP5			
MP8	Same as MP5			

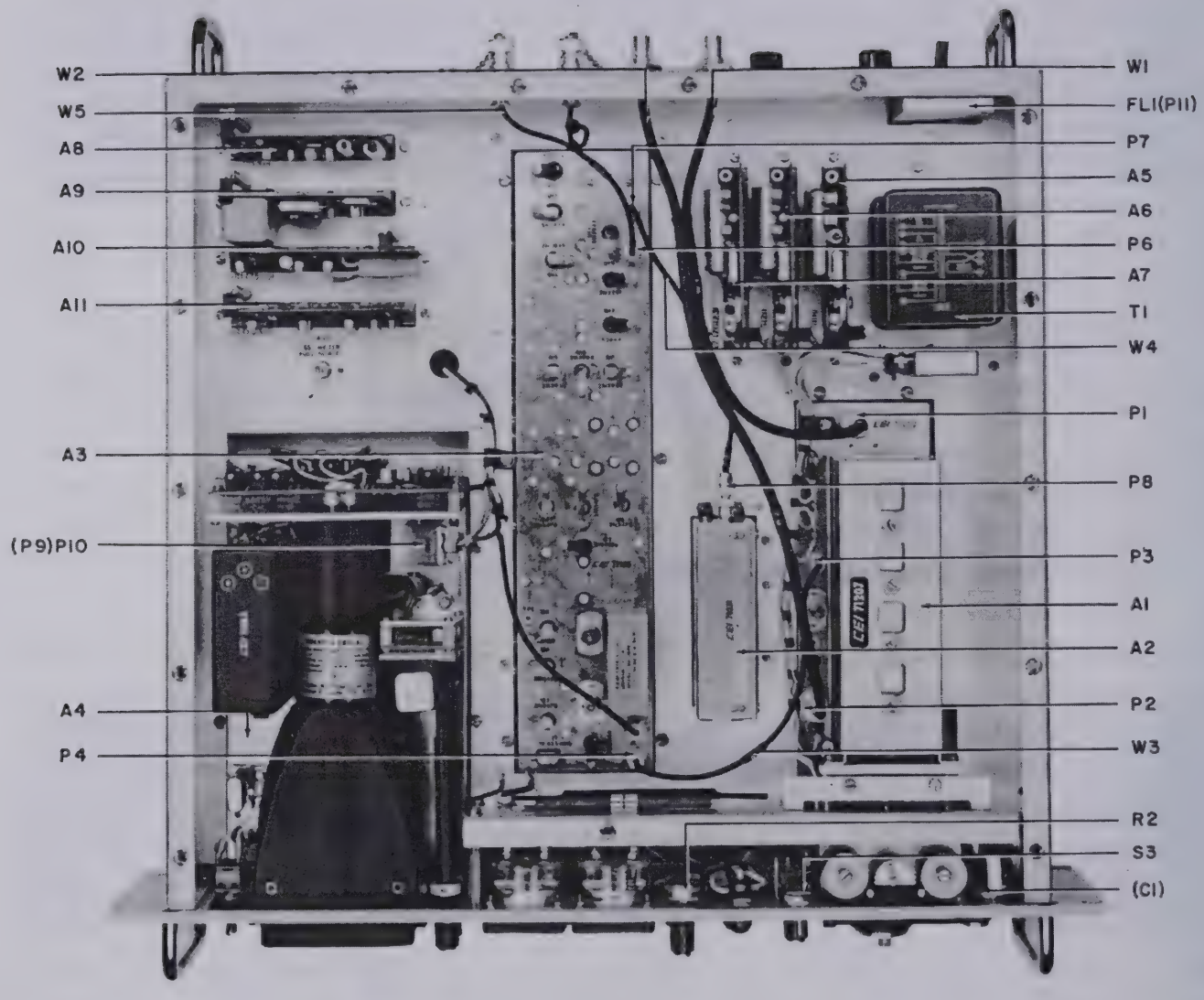


Figure 5-3. Type 521A Receiver Top View

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
MP9	Same as MP5			
MP10	Same as MP5			
MP11	Same as MP5			
MP12	Same as MP5			
MP13	Same as MP5			
MP14	Same as MP5			
MP15	KNOB	3	PS70D-2	21604
MP16	Same as MP15			
MP17	Same as MP15			
MP18	DUST CAP CONNECTOR	2	31006	74868
MP19	Same as MP18			
MP20	HANDLE	2	1252-1	71279
MP21	Same as MP20			
MP22	HANDLE	2	1250-1	71279
MP23	Same as MP22			
MP24	COVER, TOP	1	31354	14632
MP25	COVER, BOTTOM	1	31341	14632
P1	CONNECTOR, PLUG, BNC SERIES, Part of W1	2	UG-88/U	81349
P2	Same as P1, Part of W2			
P3	CONNECTOR, PLUG, MB SERIES, Part of W3	5	44950	74868
P4	Same as P3, Part of W3			
P5	NOT USED			
P6	Same as P3, Part of W5			
P7	Same as P3, Part of W4			
P8	Same as P3, Part of W4			
P9	CONNECTOR, PLUG, MULTIPIN	1	SM-2P	81312
P10	CONNECTOR, PLUG, MULTIPIN	1	SMRE-7SG	81312
P11	CONNECTOR, PLUG AND POWER CORD, Part of FL1	--		
R1	RESISTOR, VARIABLE, COMPOSITION: 25 kΩ, 10%, 1/2W	1	PQ11-120/76-4	75042
R2	RESISTOR, VARIABLE, COMPOSITON: 50 kΩ, 10%, 1/2W	3	NX24430	71450
R3	Same as R2			
R4	Same as R2			

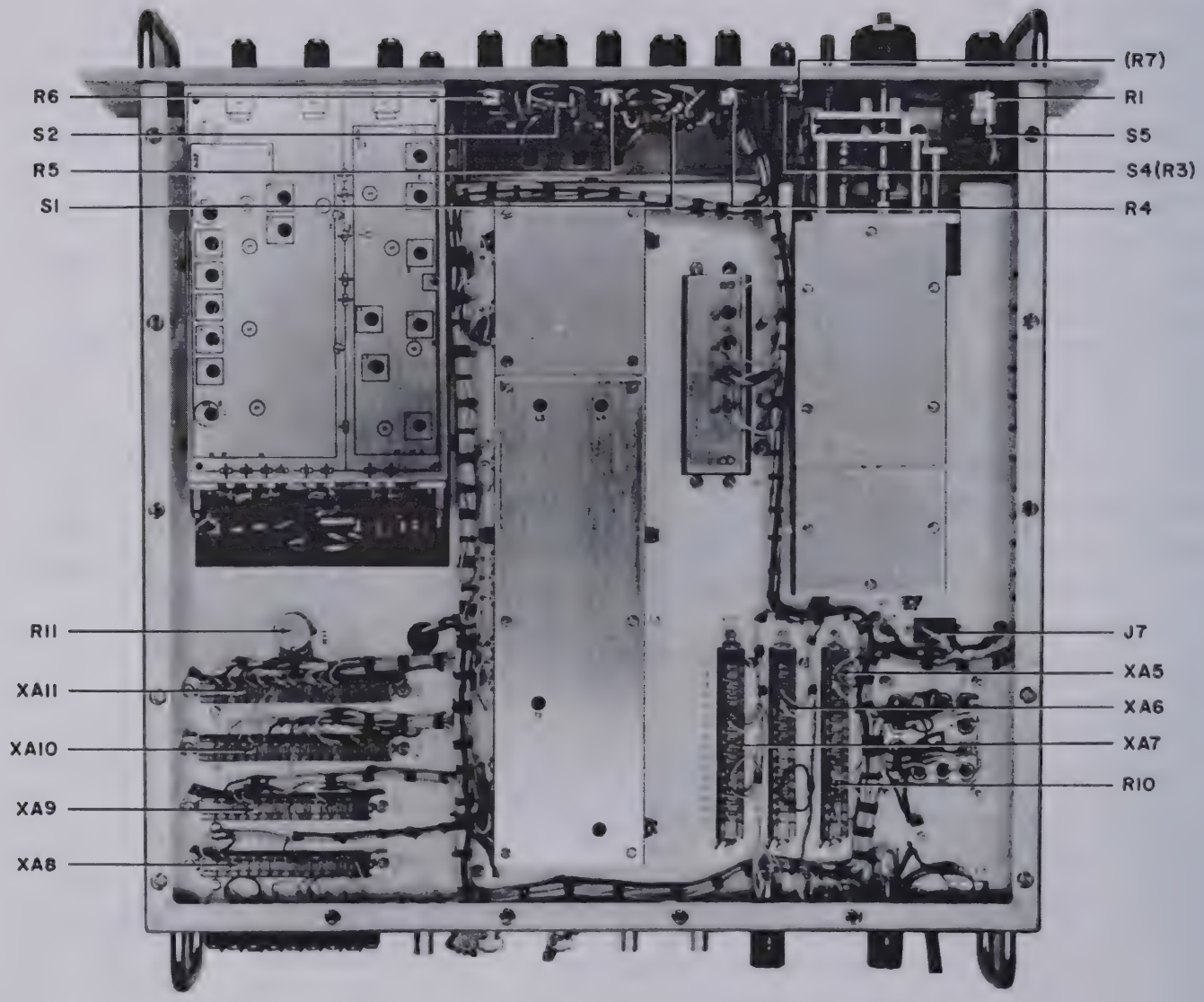


Figure 5-4. Type 521A Receiver, Bottom View

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R5	RESISTOR, VARIABLE, COMPOSITION: 10 kΩ, 10%, 1/2W	2	LW23562	71450
R6	Same as R5			
R7	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	CB4725	01121
R8	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	1	CB1835	01121
R9	RESISTOR, FIXED, COMPOSITION: 7.5 kΩ, 5%, 1/4W	1	CB7525	01121
R10	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	CB1825	01121
R11	RESISTOR, VARIABLE, COMPOSITION: 25 kΩ, 10%, 1/2W	1	RV5LAYSB253A	81349
S1	SWITCH, ROTARY: 2 Section, 4 Pole, 2-6 Position	1	1128-03	14632
S2	SWITCH, ROTARY: 1 Section, 1 Pole, 2-12 Postion	1	1128-22	14632
S3	SWITCH, TOGGLE, SP-ST	1	8280-K16	15605
S4	SWITCH, TOGGLE, SP-DT	1	8282-K14	15605
S5	SWITCH, SP-ST, Part of R1	1	76-4	75042
S6	SWITCH, SLIDE, DP-DT	1	11A-1009	82389
T1	TRANSFORMER	1	14057	14632
TB1	TERMINAL BOARD	1	353-18-07-001	71785
W1	CABLE AND CONNECTOR ASSEMBLY	Ref	30020-727	14632
W2	CABLE AND CONNECTOR ASSEMBLY	Ref	30020-728	14632
W3	CABLE AND CONNECTOR ASSEMBLY	Ref	30020-729	14632
W4	CABLE AND CONNECTOR ASSEMBLY	Ref	30020-730	14632
W5	CABLE AND CONNECTOR ASSEMBLY	Ref	30020-731	14632
XA1	NOT USED			
XA2	NOT USED			
XA3	NOT USED			
XA4	NOT USED			
XA5	CONNECTOR, PRINTED CIRCUIT BOARD	5	00-5002-016-103-002	91662
XA6	Same as XA5			
XA7	Same as XA5			
XA8	CONNECTOR, PRINTED CIRCUIT BOARD	2	00-5002-014-103-002	91662
XA9	Same as XA8			
XA10	Same as XA5			

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
XA11	Same as XA5			
XDS1	LAMPHOLDER	1	107-1930-0974-201	72619
XF1	FUSEHOLDER	2	342004	75915
XF2	Same as XF1			

5.4.2 Type 71207 20-70 MHz Tuner Assembly

REF DESIG PREFIX A1

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
A1	20-70 MHz RF TUNER	1	71187	14632
A2	GEAR TRAIN	1	8553	14632
P1	CONNECTOR, PLUG, MULTIPIN, part of W1	1	MRE-14PG7	81312
W1	CABLE AND CONNECTOR ASSEMBLY	Ref		14632

REF DESIG PREFIX A1

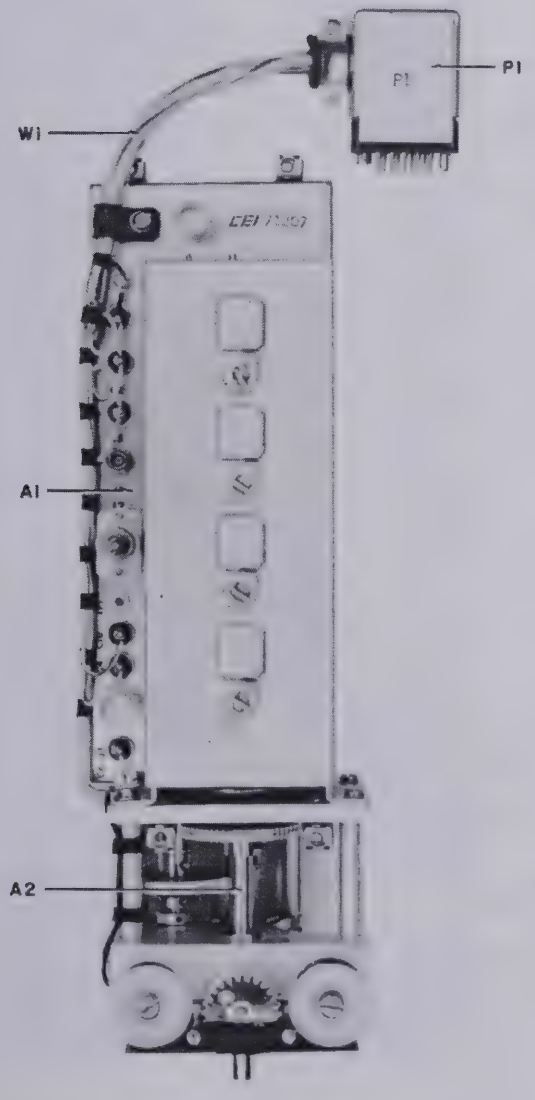


Figure 5-5. Type 71207 20-70-MHz RF Tuner Assembly, Component Locations

5.4.2.1 Type 71187 20-70 MHz RF Tuner REF DESIG PREFIX A1A1

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
A1	RF AMPLIFIER	1	13707	14632
A2	INTERSTAGE/MIXER	1	13708	14632
A3	OSCILLATOR/BUFFER	1	13709	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500V	7	FA5C-102W	01121
C2	Same as C1			
C3	Same as C1			
C4	Same as C1			
C5	Same as C1			
C6	Same as C1			
C7	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	2	SM(.001 μF, GMV)	91418
C8	CAPACITOR, CERAMIC, FEEDTHRU: 330 pF, ±10%	1	FA5C-3311	01121
C9	Same as C7			
C10	Same as C1			
CR1	DIODE	1	V27E	01281
J1	CONNECTOR, RECEPTACLE, BNC	1	UG-1094/U	81349
J2	CONNECTOR, RECEPTACLE, MB	1	46025	74868
J3	Same as J1			
L1	INDUCTUNER, 4 Section	1	2027-8	14632
L2	COIL, VARIABLE	1	1472-5	14632
L3	COIL, FIXED	2	1131-41	14632
L4	Same as L3			
Q1	TRANSISTOR	1	TA-2644	02735
R1	RESISTOR, FIXED, COMPOSITION: 4.7 k, 5%, 1/4W	1	CB4725	01121
R2	RESISTOR, FIXED, COMPOSITION: 33 k, 5%, 1/4W	1	CB3335	01121
R3	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	1	CB1045	01121
R4	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/4W	1	CB2225	01121
R5	Same as R4			
TP1	TEST POINT	1	TJ-6	04013

REF DESIG PREFIX A1A1

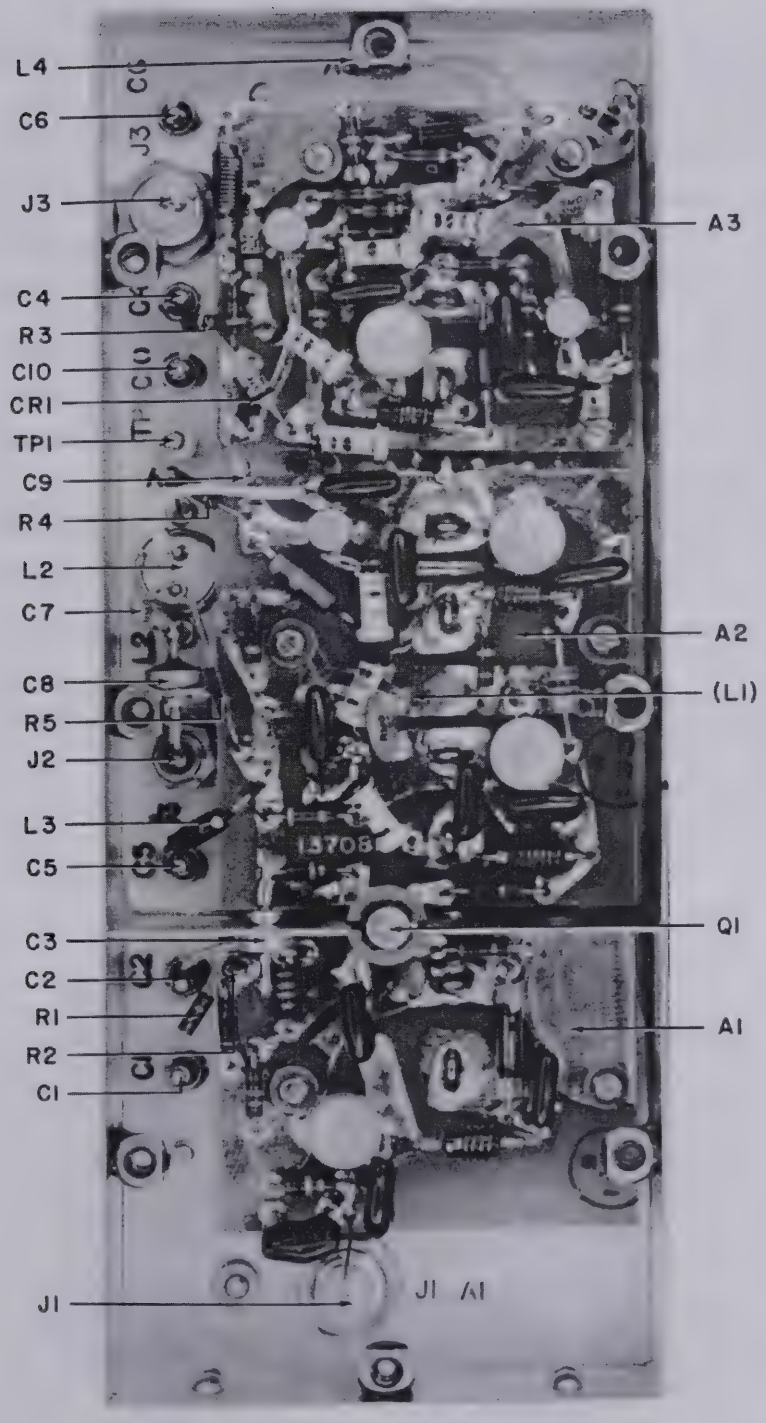


Figure 5-6. Type 71187 20-70-MHz RF Tuner, Component Locations

5.4.2.2 Type 13707 RF Amplifier REF DESIG PREFIX A1A1A1

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, DIPPED MICA: 51 pF, 5%, 500V	1	CM05E510J03	81349
C2	CAPACITOR, DIPPED MICA: 130 pF, 5%, 500V	1	CM05F131J03	81349
C3	CAPACITOR, VARIABLE, CERAMIC: 2-8 pF	1	538-011-C0P0-89R	72982
C4	CAPACITOR, DIPPED MICA: 43 pF, 5%, 500V	1	CM05E430J03	81349
C5	CAPACITOR, DIPPED MICA: 270 pF, 5%, 500V	1	CM05F271J03	81349
C6	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	1	SM(.001 μF, GMV)	91418
CR1	DIODE	1	1N462A	80131
L1	COIL, FIXED	1	1131-44	14632
L2	COIL, FIXED	1	1131-40	14632
R1	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	1	CB1045	01121
R2	RESISTOR, FIXED, COMPOSITION: 330 k, 5%, 1/4W	1	CB3345	01121
R3	RESISTOR, FIXED, COMPOSITION: 20 k, 5%, 1/4W	1	CB2035	01121
R4	RESISTOR, FIXED, COMPOSITION: 300 Ω, 5%, 1/4W	1	CB3015	01121

REF DESIG PREFIX A1A1A1

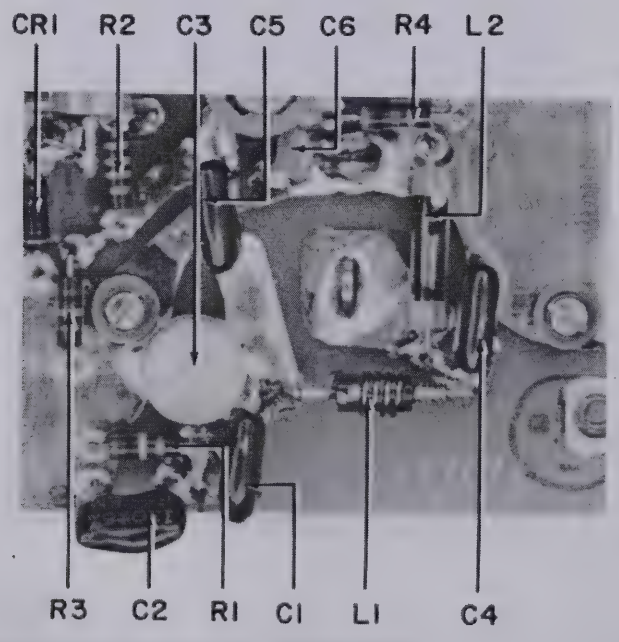


Figure 5-7. Type 13707 RF Amplifier Component Locations

5.4.2.3 Type 13708 Interstage/Mixer REF DESIG PREFIX A1A1A2

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, DIPPED MICA: 36 pF, 5%, 500V	1	CM05E360J03	81349
C2	CAPACITOR, VARIABLE, CERAMIC: 2-8 pF	2	538-011-C0P0-89R	72982
C3	CAPACITOR, DIPPED MICA: 43 pF, 5%, 500V	2	CM05E430J03	81349
C4	CAPACITOR, CERAMIC, DISC: .005 μF, 20%, 500V	1	SM(.005 μF, 20%)	91418
C5	CAPACITOR, COMPOSITION, TUBULAR: 0.82 pF, 10%, 500V	1	QC(.82 pF, 10%)	95121
C6	CAPACITOR, CERAMIC, TUBULAR: 6.8 pF, ±5 pF, 500V	2	301-000-C0H0-689D	72982
C7	Same as C6			
C8	CAPACITOR, DIPPED MICA: 10 pF, ±0.5 pF, 500V	1	CM05C100D03	81349
C9	Same as C2			
C10	CAPACITOR, DIPPED MICA: 36 pF, 5%, 500V	1	CM05ED360J03	81349
C11	Same as C3			
C12	CAPACITOR, CERAMIC, TUBULAR: 2.7 pF, ±.25 pF, 500V	1	301-000-C0J0-279C	72982
C13	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	2	SM(.001 μF, GMV)	91418
C14	Same as C13			
C15	CAPACITOR, DIPPED MICA: 27 pF, 5%, 500V	1	CM05E270J03	81349
L1	COIL, FIXED	2	1131-72	14632
L2	Same as L1			
L3	COIL, FIXED	1	21210-13	14632
Q1	TRANSISTOR	1	3N128	80131
R1	RESISTOR, FIXED, COMPOSITION: 10.0 Ω, 5%, 1/4W	1	CB1005	01121
R2	RESISTOR, FIXED, COMPOSITION: 150 k, 5%, 1/4W	1	CB1545	01121
R3	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	CB4715	01121
R4	RESISTOR, FIXED, COMPOSITION: 2.4 k, 5%, 1/4W	1	CB2425	01121
R5	RESISTOR, FIXED, COMPOSITION: 1.5 k, 5%, 1/4W	1	CB1525	01121
T1	TRANSFORMER, RF	1	11464-23	14632

REF DESIG PREFIX A1A1A2

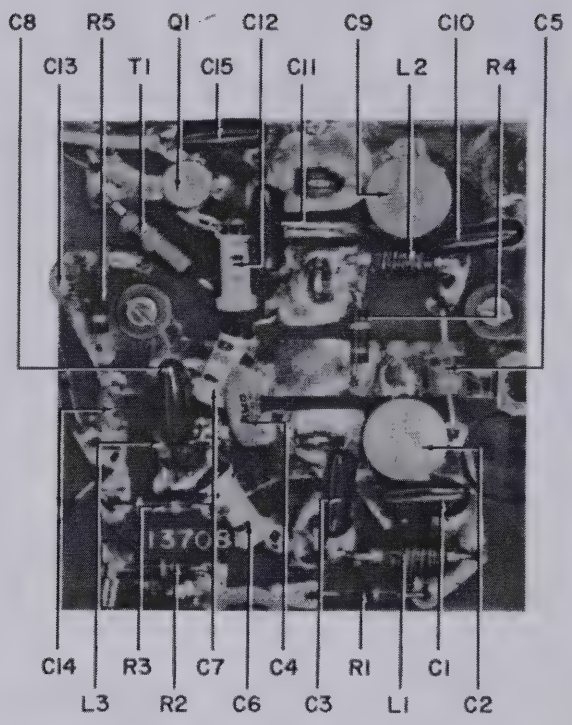


Figure 5-8. Type 13708 Interstage/Mixer, Component Locations

REF DESIG PREFIX A1A1A3

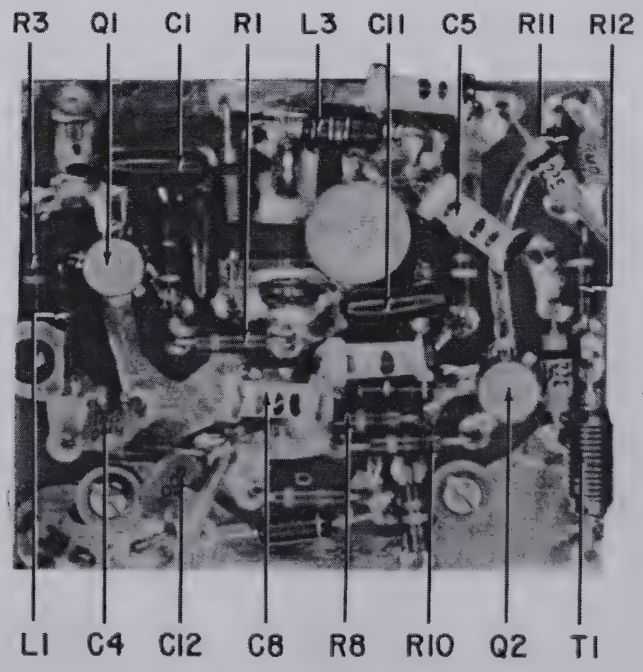


Figure 5-9. Type 13709 Oscillator/Buffer, Component Locations

5.4.2.4 Type 13709 Oscillator/Buffer REF DESIG PREFIX A1A1A3

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, DIPPED MICA: 68 pF, 5%, 500V	1	CM05E680J03	81349
C2	CAPACITOR, DIPPED MICA: 39 pF, 5%, 500V	1	CM05E390J03	81349
C3	CAPACITOR, CERAMIC, TUBULAR: 20 pF, 20%, 500V (TC-N750)	1	TCN-20	71590
C4	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	2	SM(.001 μF, GMV)	91418
C5	CAPACITOR, CERAMIC, TUBULAR: 1.5 pF, ±.1 pF, 500V	1	301-000- C0K0-159B	72982
C6	CAPACITOR, VARIABLE, CERAMIC: 2-8 pF	1	538-011-C0P0-89R	72982
C7	CAPACITOR, CERAMIC, TUBULAR: 4.7 pF, ±.25 pF, 500V (TC-N750)	1	301-000-U2J0-479C	72982
C8	CAPACITOR, CERAMIC, TUBULAR: 10.0 pF, ±.5 pF, 500V (TC-N750)	1	301-000-U2J0-100D	72982
C9	CAPACITOR, CERAMIC, TUBULAR 2.7 pF, ±.25 pF, 500V	1	301-000-C0K0-279C	72982
C10	Same as C4			
C11	CAPACITOR, DIPPED MICA: 36 pF, 5%, 500V	1	CM05E360J03	81349
C12	CAPACITOR, CERAMIC, DISC 0.005 μF, 20%, 500V	1	SM(.005 μF, 20%)	91418
CR1	VARICAP	1	V27E	01281
CR2	DIODE	1	1N758A	80131
L1	COIL, FIXED	1	21209-1	14632
L2	COIL, FIXED	1	21210-1	14632
L3	COIL, FIXED	1	1131-70	14632
Q1	TRANSISTOR	2	2N3478	80131
Q2	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/4W	1	CB2225	01121
R2	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	CB4705	01121
R3	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	2	CB1045	01121
R4	Same as R3			
R5	RESISTOR, FIXED, COMPOSITION: 1 k, 5%, 1/4W	1	CB1025	01121
R6	RESISTOR, FIXED, COMPOSITION: 2.7 k, 5%, 1/4W	1	CB2725	01121
R7	Same as R2			

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R8	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	CB1035	01121
R9	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	1	CB1835	01121
R10	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	CB1015	01121
R11	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	1	CB2015	01121
R12	RESISTOR, FIXED, COMPOSITION: 200 Ω, 5%, 1/4W	1	CB2015	01121
T1	TRANSFORMER, RF	1	11464-16	14632

REF DESIG PREFIX A1A1A3

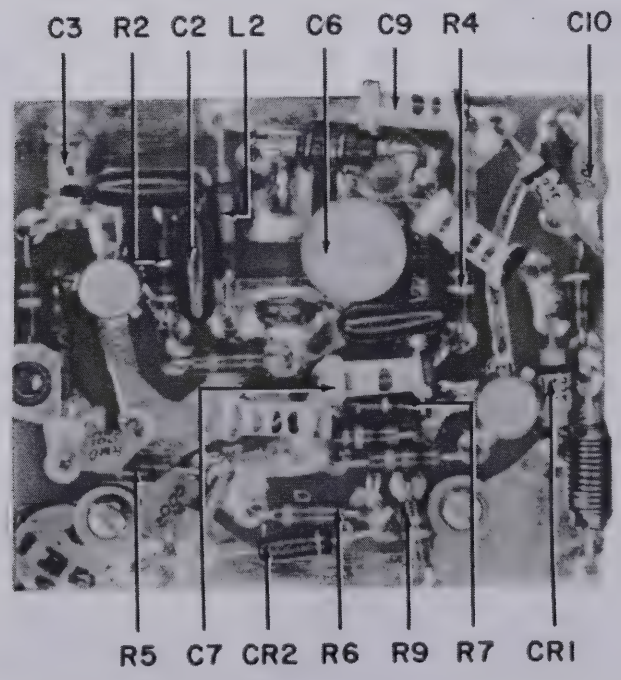


Figure 5-10. Type 13709 Oscillator/Buffer, Component Locations

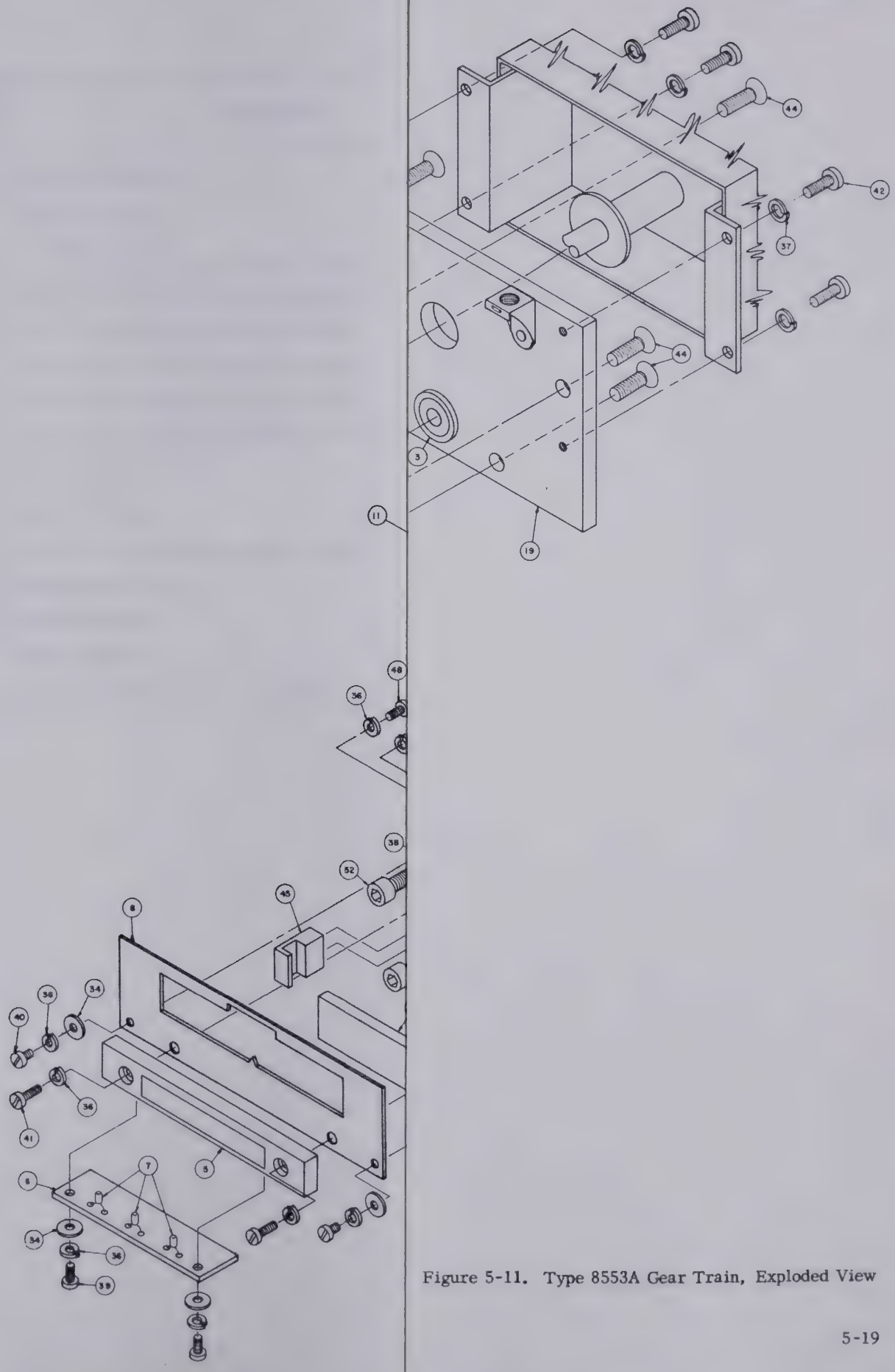


Figure 5-11. Type 8553A Gear Train, Exploded View

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R8	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	CB1035	01121
R9	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	1	CB1835	01121
R10	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	CB1015	01121
R11	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	1	CB2015	01121
R12	RESISTOR, FIXED, COMPOSITION: 200 Ω, 5%, 1/4W	1	CB2015	01121
T1	TRANSFORMER, RF	1	11464-16	14632

REF DESIG PREFIX A1A1A3

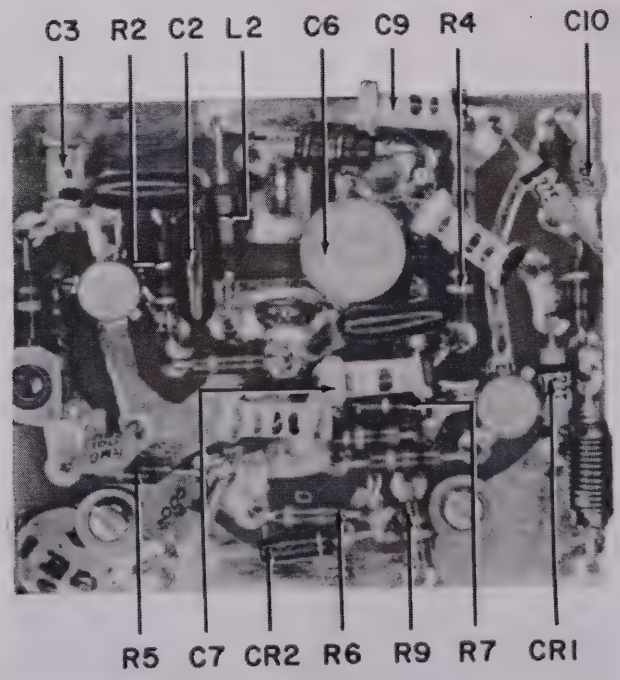


Figure 5-10. Type 13709 Oscillator/Buffer, Component Locations

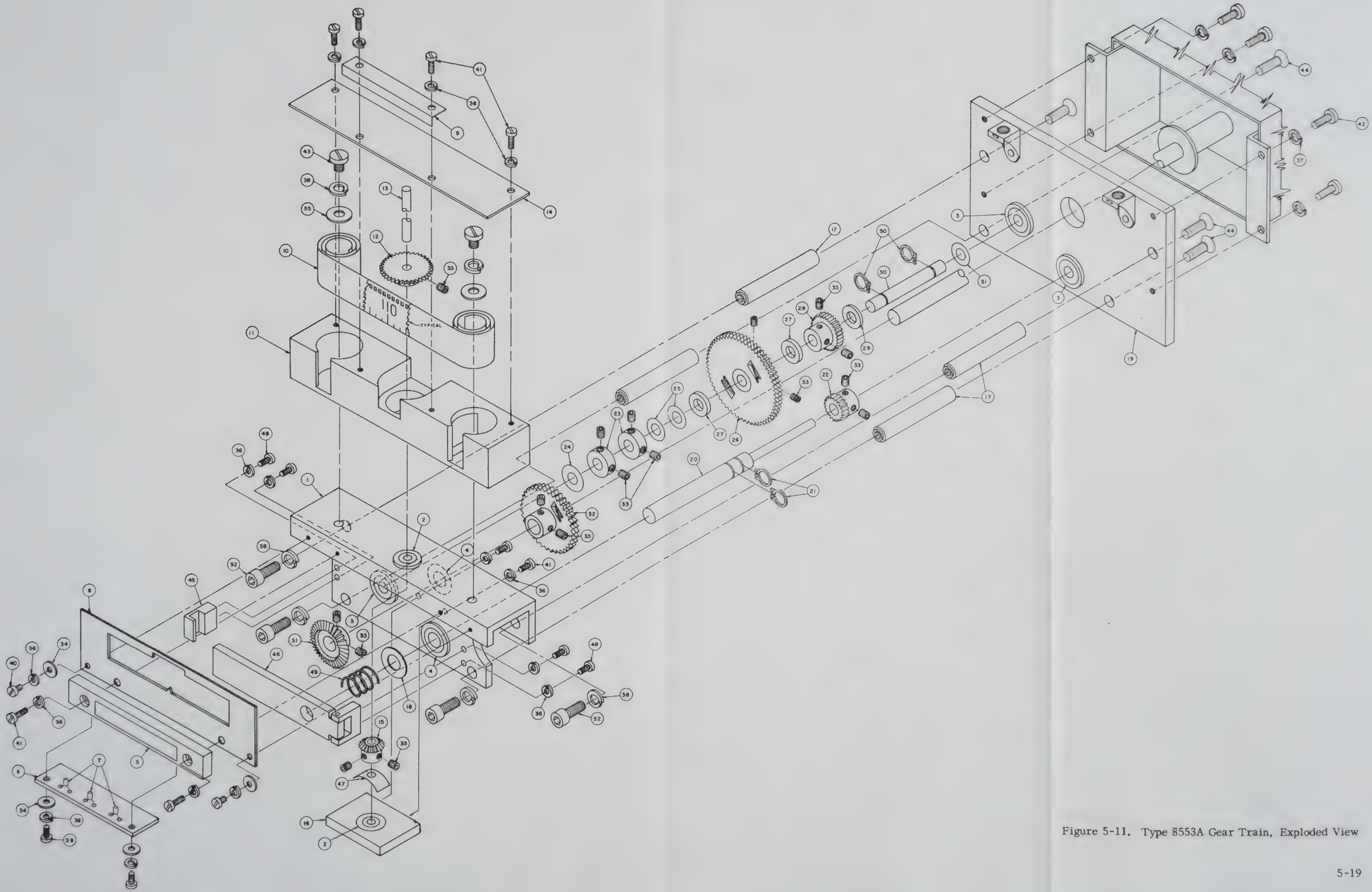


Figure 5-11. Type 8553A Gear Train, Exploded View

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
36	# 2 LOCK WASHER	AR	MS35338-77	96906
37	# 4 LOCK WASHER	AR	MS35338-78	96906
38	# 6 LOCK WASHER	AR	MS35338-79	96906
39	2-56 x 3/16 FIL HEAD MACHINE SCREW	AR	AN500D2-3	88044
40	2-56 x 3/16 PAN HEAD MACHNE SCREW	AR	MS35233-2	96906
41	2-56 x 1/4 PAN HEAD MACHINE SCREW	AR	MS35233-3	96906
42	4-40 x 5/16 PAN HEAD MACHINE SCREW	AR	MS35233-14	96906
43	6-32 x 1/4 PAN HEAD MACHINE SCREW	AR	MS35233-26	96906
44	6-32 x 1/2 FLAT HEAD MACHINE SCREW	AR	MS35239-37	96906
45	STOP HINGE RETAINER	1	14037	14632
46	STOP ASSEMBLY	1	13960	14632
47	TENSION SPRING	1	13944	14632
48	2-56 x 5/16 PAN HEAD MACHINE SCREW	AR	MS35233-4	96906
49	COMPRESSING SPRING	1	C360-026-0500	81349
50	RETAINING RING	2	5100-18	79136
51	SHIM, SPACER	AR	SSS-23	01351
52	6-32 x 3/8 SOCKET HEAD CAP SCREW	AR	MS35459-7	96906

Figure 5-11a

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
1	ANGLE PLATE	1	21292	14632
2	BEARING	2	SFR2-63MM	83086
3	BEARING	3	SFR33MM	83086
4	BEARING	2	SFR1883MM	83086
5	LIGHT BAR	1	13963	14632
6	LIGHT BOARD	1	14004	14632
7	LAMP, INCANDESCENT (DS1, DS2, DS3)	3	CM8-725	71744
8	GUIDE PLATE	1	11127	14632
9	ANGLE PLATE	1	14043	14632
10	CALIBRATED TAPE	1	30958	14632
11	TAPE CHAMBER	1	31358-1	14632
12	GEAR, TAPE DRIVE	1	14065	14632
13	SHAFT	1	13908-4	14632
14	COVER	1	14044	14632
15	PINION GEAR	1	11136	14632
16	SUPPORT PLATE	1	11147-5	14632
17	SPACER	4	20757-23	14632
18	WASHER	1	1000-2	14632
19	REAR PLATE	1	13502	14632
20	SHAFT, DRIVE	1	1002-84	14632
21	RING, RETAINING	2	5100-25	79136
22	GEAR, SPUR	1	13955	14632
23	COLLAR	2	11581-6	14632
24	SPACER, SHIM	AR	SS-33	01351
25	SPRING WASHER	AR	7752	04941
26	GEAR, ANTI-BACKLASH	1	20182-1	14632
27	CLUTCH BEARING	2	11582-1	14632
28	GEAR, SPUR	1	2984-10	14632
29	SHIM, BEARING	1	11138-2	14632
30	SHAFT, IDLER	1	21352-1	14632
31	BEVEL GEAR	1	11135	14632
32	GEAR, ANTI-BACKLASH	1	20180-6	14632
33	4-40 x 1/8 SET SCREW	AR	AN565DC4-2	88044
34	# 2 FLAT WASHER	AR	MS15795-302	96906
35	# 6 FLAT WASHER	AR	MS15795-306	96906

Figure 5-11b

5.4.3 Type 79331 FM Limiter/Discriminator

REF DESIG PREFIX A2

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
A1	FM LIMITER/DISCRIMINATOR	1	14017	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU: 0.001 μF, GMV, 500V	3	FA5C-102W	01121
C2	Same as C1			
C3	CAPACITOR, CERAMIC, FEEDTHRU: 330 pF, 10%, 500V	1	FA5C-3311	01121
C4	Same as C1			
J1	CONNECTOR, RECEPTACLE, MB	1	46025	74868
R1	RESISTOR, FIXED, COMPOSITION: 56 kΩ, 5%, 1/4W	1	CB5635	01121

REF DESIG PREFIX A2

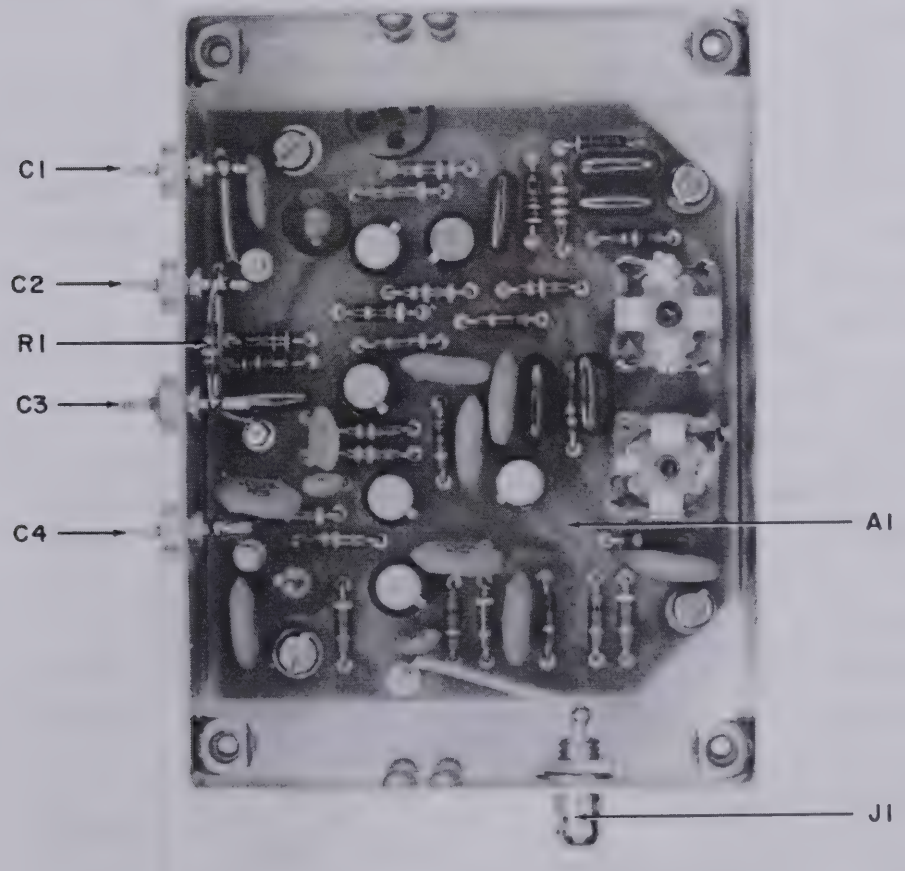


Figure 5-12. Type 79331 FM Limiter/Discriminator, Component Locations

5.4.3.1 Type 14017 Limiter/Discriminator Board REF DESIG PREFIX A2A1

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, CERAMIC, DISC: 0.001 μF, GMV, 500V	2	SM(.001 μF, GMV)	91418
C2	CAPACITOR, CERAMIC, DISC: 0.05 μF, 20%, 50V	8	55C23A1	56289
C3	Same as C2			
C4	Same as C1			
C5	Same as C2			
C6	Same as C2			
C7	Same as C2			
C8	Same as C2			
C9	CAPACITOR, DIPPED MICA: 470 pF, 5%, 500V	2	DM15-471J	72136
C10	Same as C2			
C11	CAPACITOR, DIPPED MICA: 220 pF, 5%, 500V	2	CM05F221J03	81349
C12	Same as C2			
C13	CAPACITOR, DIPPED MICA: 62 pF, 5%, 500V	1	CM05E620J03	81349
C14	Same as C9			
C15	Same as C11			
C16	CAPACITOR, DIPPED MICA: 100 pF, 5%, 500V	1	CM05F101J03	81349
C17	CAPACITOR, CERAMIC, DISC: 0.005 μF, 20%, 500V	1	SM(.005 μF, 20%)	91418
C18	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 50V	1	19C214A6	56289
CR1	DIODE	4	1N914A	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
L1	COIL, FIXED	2	3635-53	71279
L2	Same as L1			
L3	COIL, VARIABLE	1	30705-12	14632
Q1	TRANSISTOR	4	2N4074	80131
Q2	Same as Q1			
Q3	Same as Q1			
Q4	TRANSISTOR	1	2N3478	80131
Q5	TRANSISTOR	1	2N3251	80131
Q6	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	4	CB2235	01121
R2	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	6	CB4725	01121

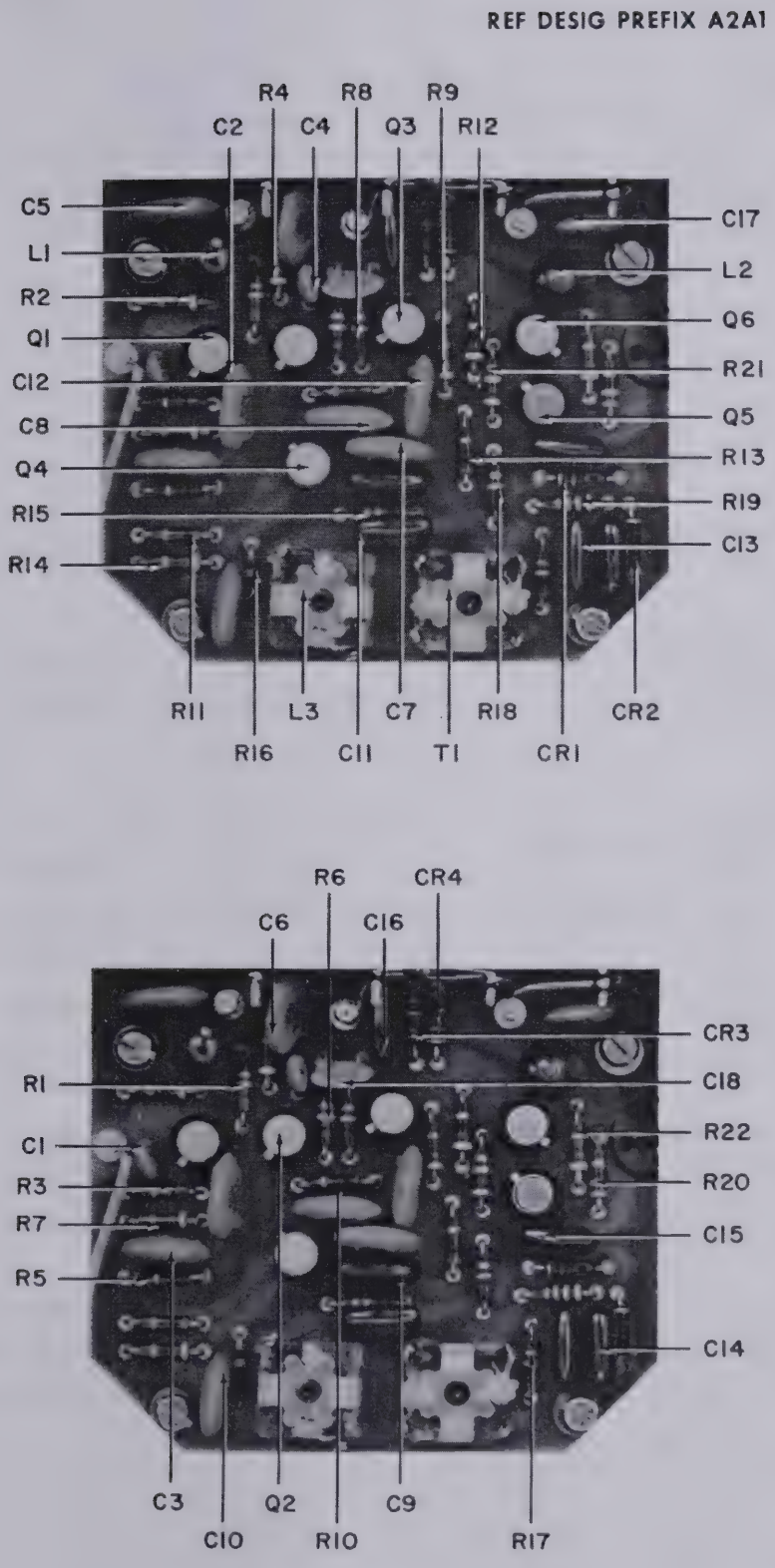


Figure 5-13. Type 14017 Limiter/Discriminator Board, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R3	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	2	CB2225	01121
R4	Same as R2			
R5	Same as R3			
R6	Same as R1			
R7	Same as R2			
R8	Same as R1			
R9	Same as R2			
R10	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	3	CB1025	01121
R11	Same as R10			
R12	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	CB4705	01121
R13	Same as R10			
R14	Same as R2			
R15	Same as R1			
R16	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	CB2205	01121
R17	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	CB1035	01121
R18	RESISTOR, FIXED, COMPOSITION: 27 kΩ, 5%, 1/4W	1	CB2735	01121
R19	RESISTOR, FIXED, COMPOSITION: 43 kΩ, 5%, 1/4W	1	CB4335	01121
R20	RESISTOR, FIXED, COMPOSITION: 3.3 MΩ, 5%, 1/4W	1	CB3355	01121
R21	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	CB4735	01121
R22	Same as R2			
T1	TRANSFORMER	1	30705-13	14632

5.4.4 Type 72186 IF Amplifier REF DESIG PREFIX A3

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500V	12	FA5C-102W	01121
C2	Same as C1			
C3	Same as C1			
C4	Same as C1			
C5	Same as C1			
C6	Same as C1			
C7	Same as C1			
C8	Same as C1			
C9	Same as C1			
C10	Same as C1			
C11	Same as C1			
C12	Same as C1			
C13	CAPACITOR, CERAMIC, DISC: .001 μF, GMV, 500V	9	SM(.001 μF, GMV)	91418
C14	Same as C13			
C15	Same as C13			
C16	CAPACITOR, DIPPED MICA: 51 pF, 5%, 500V	3	CM05E470J03	81349
C17	Same as C16			
C18	CAPACITOR, CERAMIC, DISC: .01 μF, 20%, 50V	8	19C214A6	56289
C19	CAPACITOR, CERAMIC, DISC: .005 μF, 20%, 50V	7	40C172A5	56289
C20	CAPACITOR, DIPPED MICA: 82 pF, 5%, 500V	1	CM05E820J03	81349
C21	CAPACITOR, DIPPED MICA: 430 pF, 5%, 500V	1	DM15-431J	72136
C22	Same as C13			
C23	CAPACITOR, CERAMIC, DISC: .05 μF, 20%, 50V	21	55C23A1	56289
C24	CAPACITOR, DIPPED MICA: 20 pF, 5%, 500V	1	CM05C200J03	81349
C25	Same as C13			
C26	Same as C23			
C27	Same as C23			
C28	CAPACITOR, DIPPED MICA: 910 pF, 5%, 500V	2	DM15-911J	72136
C29	CAPACITOR, DIPPED MICA: 180 pF, 5%, 500V	1	CM05F181J03	81349
C30	Same as C23			
C31	Same as C23			
C32	Same as C28			
C33	Same as C13			
C34	Same as C23			

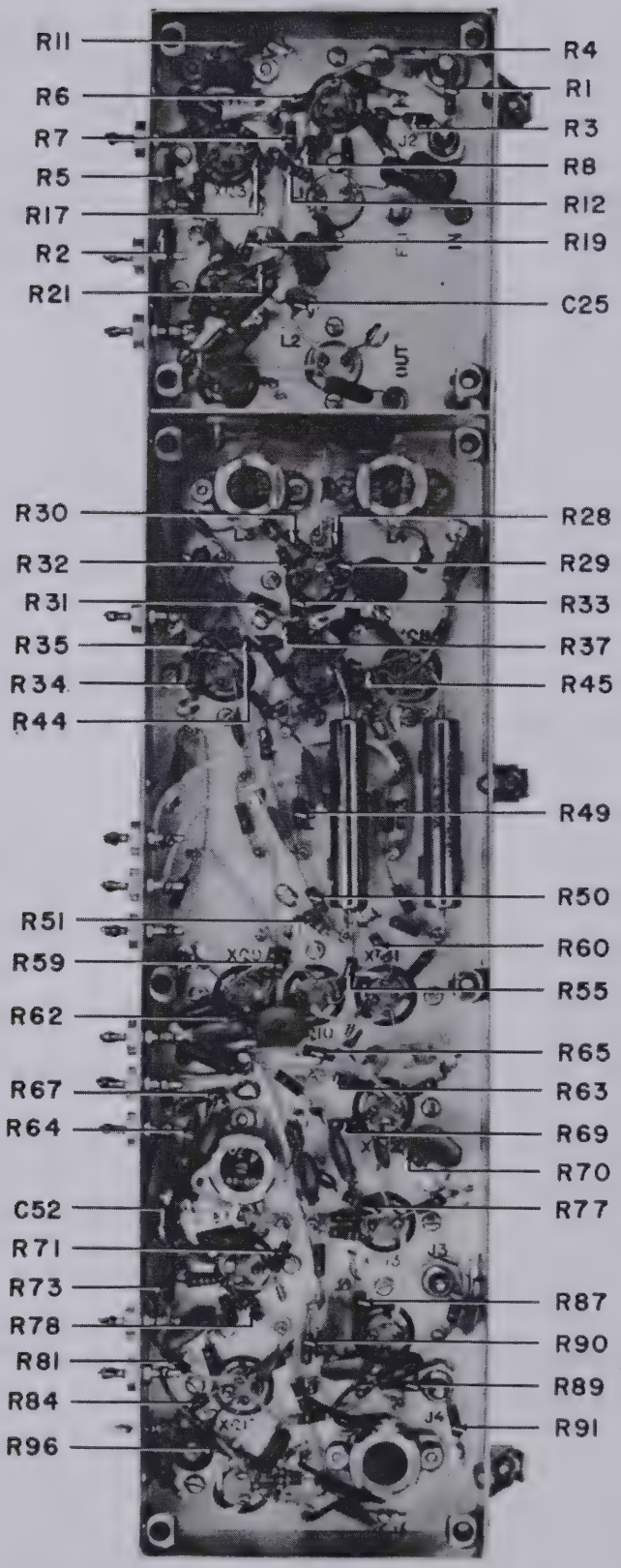


Figure 5-14. Type 72186 4/10/50-kHz Bandwidth IF Amplifier, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C35	Same as C23			
C36	Same as C19			
C37	Same as C19			
C38	Same as C19			
C39	Same as C23			
C40	Same as C18			
C41	Same as C18			
C42	Same as C18			
C43	Same as C19			
C44	Same as C23			
C45	Same as C23			
C46	CAPACITOR, DIPPED MICA: 91 pF, 5%, 500V	1	CM05F910J03	81349
C47	Same as C13			
C48	Same as C23			
C49	Same as C23			
C50	Same as C13			
C51	CAPACITOR, FIXED, MICA: 820 pF, 2%, 500V	1	CM0G8D821G03	81349
C52	Same as C18			
C53	Same as C18			
C54	Same as C23			
C55	Same as C23			
C56	Same as C19			
C57	Same as C23			
C58	Same as C23			
C59	Same as C19			
C60	Same as C23			
C61	Same as C13			
C62	Same as C23			
C63	Same as C23			
C64	CAPACITOR, DIPPED MICA: 130 pF, 5%, 500V	1	CM05F131J03	81349
C65	Same as C18			
C66	Same as C18			
C67	Same as C16			
C68	Same as C23			

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C69	Same as C23			
C70	CAPACITOR, DIPPED MICA: 220 pF, 5%, 500V	1	CM05F221J03	81349
C71	CAPACITOR, FIXED, CERAMIC, TUBULAR: 100 pF, 2%, 600V	1	TCN100	71590
C72	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100V	1	C023B101E502M	56289
CR1	DIODE	3	1N462A	80131
CR2	DIODE, CAPACITANCE	2	MV840	04713
CR3	Same as CR2			
CR4	Same as CR1			
CR5	DIODE	1	1N914A	80131
CR6	Same as CR1			
CR7	DIODE	2	1N198	80131
CR8	Same as CR7			
E1	TERMINAL FEEDTHRU, GLASS	1	1125-SW-30	97814
E2	TERMINAL FEEDTHRU, TEFLON	1	TJ-6	04013
FB1	FERRITE BEAD	3	56-590-65/4A	02114
FB2	Same as FB1			
FB3	Same as FB1			
FL1	FILTER, QUARTZ: 10 MHz Center Frequency; 50 kHz B. W.	1	6073680	74306
FL2	FILTER, CERAMIC: 455 kHz Center Frequency; 10 kHz B. W.	1	TL10D16A	06961
FL3	FILTER CERAMIC: 455 kHz Center Frequency; 4 kHz B. W.	1	TL4D8A	06961
J1	CONNECTOR, RECEPTACLE, MB SERIES	4	46025	74868
J2	Same as J1			
J3	Same as J1			
J4	Same as J1			
L1	COIL, VARIABLE	1	1472-3	14632
L2	COIL, VARIABLE	1	1472-5	14632
L3	COIL, VARIABLE	2	30311-5	14632
L4	Same as L3			
L5	COIL, FIXED	3	1131-37	14632
L6	Same as L5			
L7	COIL, FIXED: 22 mH	1	3635-53	71279
L8	Same as L5			
MP1	COVER, SMALL	1	14052	14632

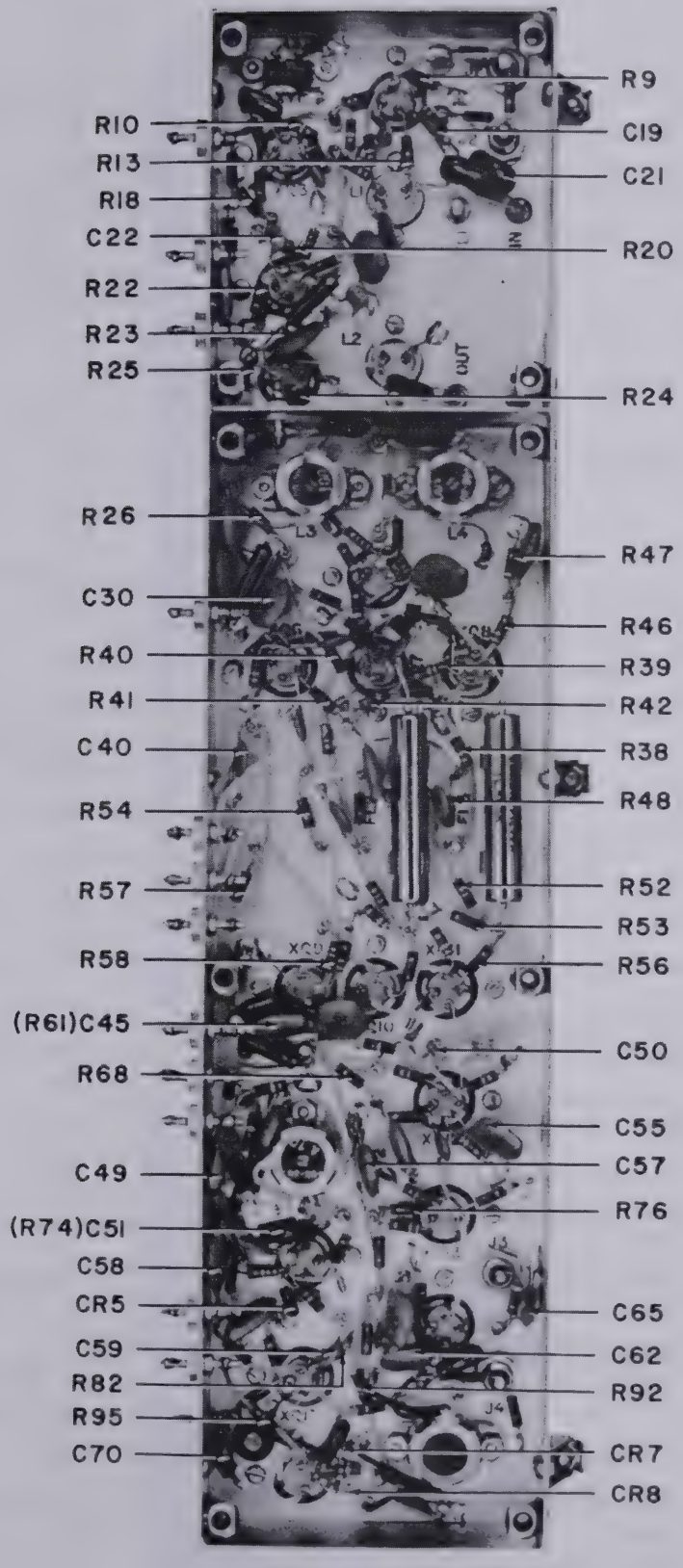


Figure 5-15. Type 72186 4/10/50-kHz Bandwidth IF Amplifier, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
MP2	COVER, LARGE	1	21340	14632
Q1	TRANSISTOR	2	TA2644	02735
Q2	TRANSISTOR	1	3N128	80131
Q3	TRANSISTOR	5	2N3478	80131
Q4	Same as Q3			
Q5	TRANSISTOR	2	2N4074	80131
Q6	Same as Q3			
Q7	Same as Q3			
Q8	Same as Q3			
Q9	TRANISTOR	6	2N3933	80131
Q10	Same as Q9			
Q11	Same as Q9			
Q12	Same as Q1			
Q13	TRANSISTOR	1	2N3251	80131
Q14	Same as Q9			
Q15	Same as Q5			
Q16	Same as Q9			
Q17	Same as Q9			
R1	RESISTOR, FIXED, COMPOSITION: 68 Ω, 5%, 1/4W	1	CB6805	01121
R2	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	7	CB4725	01121
R3	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	9	CB1015	01121
R4	Same as R3			
R5	RESISTOR, FIXED, COMPOSITION: 27 kΩ, 5%, 1/4W	3	CB2735	01121
R6	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	7	CB1035	01121
R7	RESISTOR, FIXED COMPOSITION: 150 kΩ, 5%, 1/4W	3	CB1545	01121
R8	Same as R7			
R9	Same as R6			
R10	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	1	CB2245	01121
R11	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	1	CB4745	01121

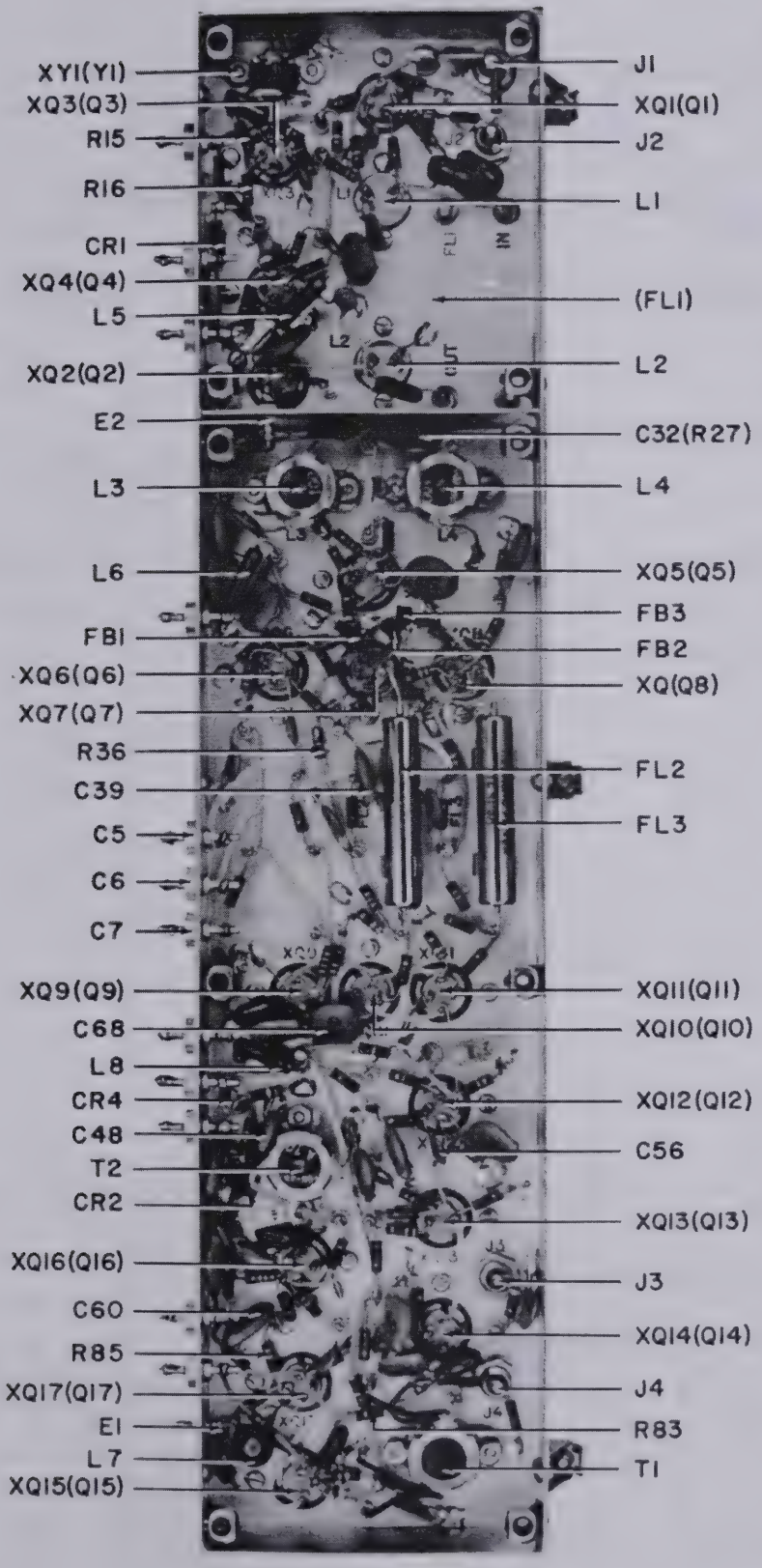


Figure 5-16. Type 72186 4/10/50-kHz Bandwidth IF Amplifier, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R12	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	4	CB3315	01121
R13	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	2	CB1005	01121
R14	Same as R12			
R15	Same as R3			
R16	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	9	CB2225	01121
R17	Same as R2			
R18	Same as R16			
R19	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	5	CB3335	01121
R20	RESISTOR, FIXED, COMPOSITION: 16 kΩ, 5%, 1/4W	1	CB1635	01121
R21	Same as R2			
R22	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	CB5625	01121
R23	Same as R16			
R24	Same as R13			
R25	Same as R16			
R26	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	10	CB1025	01121
R27	Same as R16			
R28	Same as R3			
R29	Same as R19			
R30	Same as R19			
R31	Same as R26			
R32	Same as R2			
R33	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	4	CB4705	01121
R34	RESISTOR, FIXED, COMPOSITION: 22 k, 5%, 1/4W	3	CB2235	01121
R35	Same as R2			
R36	Same as R34			
R37	Same as R2			
R38	Same as R34			
R39	Same as R2			
R40	Same as R26			

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R41	RESISTOR, FIXED, COMPOSITION: 560 Ω, 5%, 1/4W	2	CB5615	01121
R42	RESISTOR, FIXED, COMPOSITION: 2.4 kΩ, 5%, 1/4W	1	CB2425	01121
R43	Same as R16			
R44	Same as R3			
R45	Same as R12			
R46	RESISTOR, FIXED, COMPOSITION: 430 Ω, 5%, 1/4W	2	CB4315	01121
R47	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	CB4715	01121
R48	Same as R26			
R49	Same as R26			
R50	Same as R19			
R51	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	2	CB3325	01121
R52	Same as R5			
R53	RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W	1	CB2725	01121
R54	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	2	CB1515	01121
R55	Same as R3			
R56	Same as R3			
R57	Same as R26			
R58	Same as R19			
R59	Same as R51			
R60	RESISTOR, FIXED, COMPOSITION: 750 Ω, 5%, 1/4W	1	CB7515	01121
R61	Same as R47			
R62	Same as R16			
R63	Same as R6			
R64	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	3	CB2245	01121
R65	Same as R7			
R66	Same as R6			
R67	Same as R64			
R68	Same as R3			

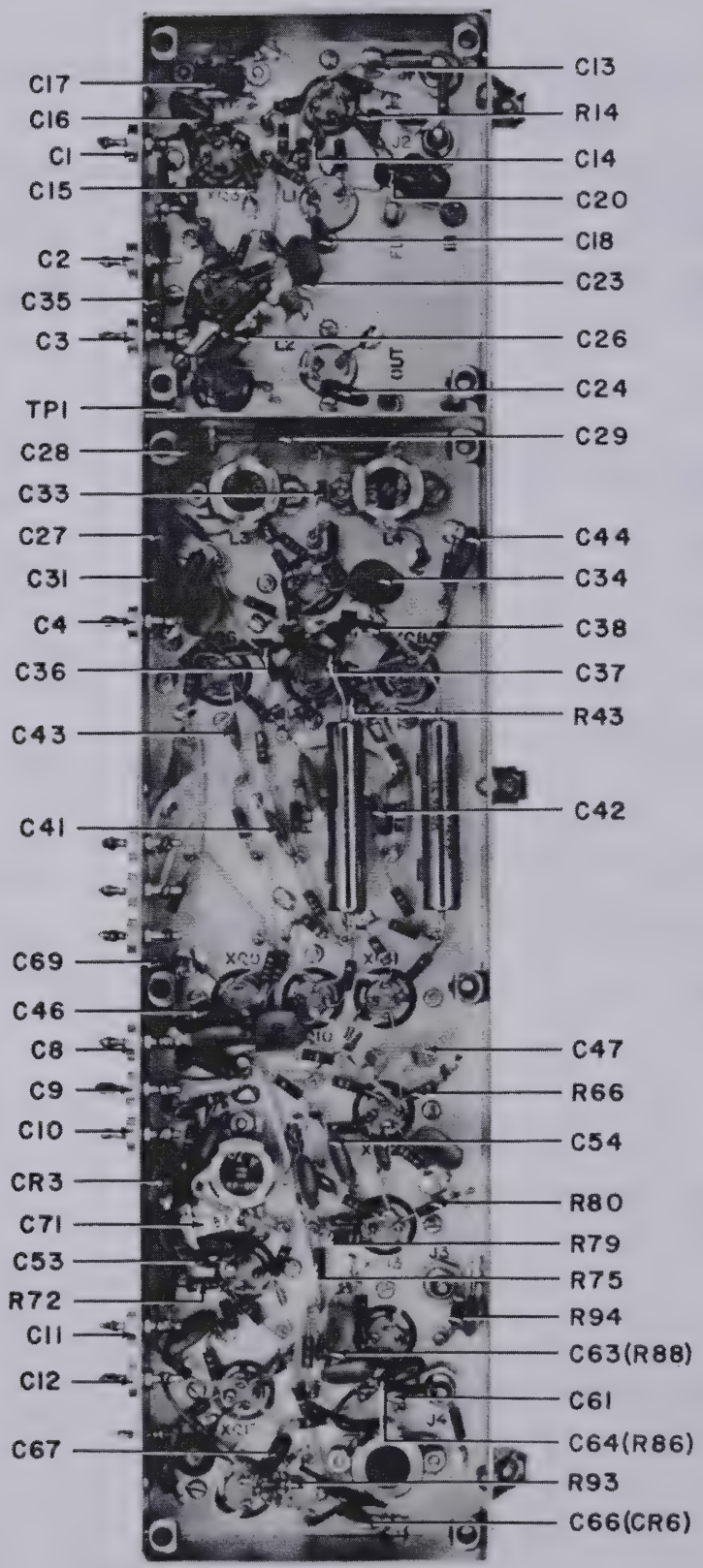


Figure 5-17. Type 72186 4/10/50-kHz Bandwidth IF Amplifier, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R69	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	1	CB1525	01121
R70	Same as R12			
R71	Same as R26			
R72	RESISTOR, FIXED, COMPOSITION: 330 kΩ, 5%, 1/4W	1	CB3345	01121
R73	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	CB1535	01121
R74	Same as R3			
R75	Same as R26			
R76	Same as R16			
R77	Same as R5			
R78	RESISTOR, FIXED, COMPOSITION: 68 kΩ, 5%, 1/4W	1	CB6835	01121
R79	Same as R46			
R80	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	CB1825	01121
R81	Same as R64			
R82	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	2	CB4735	01121
R83	Same as R33			
R84	Same as R16			
R85	Same as R6			
R86	Same as R33			
R87	Same as R41			
R88	RESISTOR, FIXED, COMPOSITION: 56 Ω, 5%, 1/4W	1	CB5605	01121
R89	Same as R6			
R90	Same as R26			
R91	Same as R54			
R92	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	1	CB1835	01121
R93	Same as R82			
R94	Same as R33			
R95	Same as R6			
R96	Same as R26			
R97	RESISTOR, FIXED, COMPOSITION: 180 Ω, 5%, 1/4W	1	CB1815	01121
R98	RESISTOR, FIXED, COMPOSITION: 2.5 kΩ, 10%, 1/2W	1	RVNAYSD252A	81349
T1	TRANSFORMER	1	30311-6	14632

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
T2	TRANSFORMER	1	30311-7	14632
TP1	TEST POINT	1	TJ-6	04013
Y1	CRYSTAL, QUARTZ: 10.455 MHz	1	CR-78/U	81349
XQ1	SOCKET, TRANSISTOR	14	22-16-4	81073
XQ2	Same as XQ1			
XQ3	Same as XQ1			
XQ4	Same as XQ1			
XQ5	SOCKET, TRANSISTOR	3	22-16-2	81073
XQ6	Same as XQ1			
XQ7	Same as XQ1			
XQ8	Same as XQ1			
XQ9	Same as XQ1			
XQ10	Same as XQ1			
XQ11	Same as XQ1			
XQ12	Same as XQ1			
XQ13	Same as XQ5			
XQ14	Same as XQ1			
XQ15	Same as XQ5			
XQ16	Same as XQ1			
XQ17	Same as XQ1			
XY1	SOCKET, CRYSTAL	1	8004-1G13	91506

5.4.5 Type 79332 Signal Monitor REF DESIG PREFIX A4

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
A1	IF AMPLIFIER	1	8121	14632
A2	SWEEP GENERATOR AND HORIZONTAL DEFLECTION AMPLIFIER	1	8229	14632
A3	FOCUS AND INTENSITY CONTROL	1	12688	14632
J1	CONNECTOR, RECEPTACLE, MULTIPIN	1	SM-2SN	81312
J2	CONNECTOR, RECEPTACLE, MULTIPIN	1	SMRE-7PG	81312
P1	CONNECTOR, PLUG, MB	1	44950	74868
PS1	DC-DC CONVERTER	1	7696	14632
S1	SWITCH, TOGGLE, SPST	1	8280-K16	15605
V1	TUBE, ELECTRON, CRT	1	3XP1	81349

REF DESIG PREFIX A4

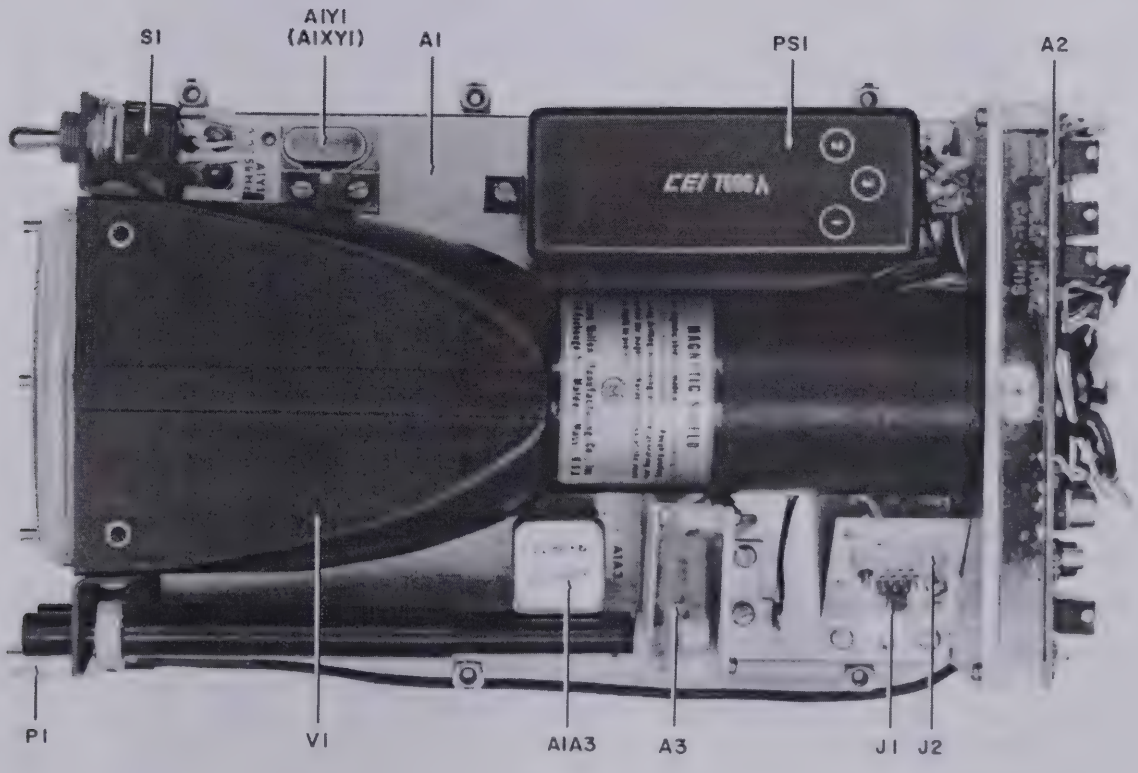


Figure 5-18. Type 79332 Signal Monitor, Component Locations

5.4.5.1 Type 8121 IF Amplifier REF DESIG PREFIX A4A1

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
A1	IF AMPLIFIER BOARD NO. 1	1	13748	14632
A2	IF AMPLIFIER BOARD NO. 2	1	13750	14632
A3	10-MHz OSCILLATOR	1	11280-6	14632
C1	NOT USED			
C2	NOT USED			
C3	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500V	10	FA5C-102W	01121
C4	Same as C3			
C5	CAPACITOR, CERAMIC, FEEDTHRU: 33 pF, 10%, 500V	3	FA5C-3301	01121
C6	Same as C3			
C7	Same as C3			
C8	Same as C3			
C9	Same as C3			
C10	Same as C3			
C11	Same as C5			
C12	Same as C5			
C13	Same as C3			
C14	Same as C3			
C15	Same as C3			
C16	CAPACITOR, CERAMIC, DISC: 0.05 μF, 20%, 50V	3	55C23A1	56289
C17	CAPACITOR, CERAMIC, STANDOFF: 1000pF, GMV, 500V	2	SS5A-102W	01121
C18	Same as C17			
C19	Same as C16			
C20	Same as C16			
E1	TERMINAL, INSULATED	1	SFU-16	04013
FB1	FERRITE BEAD	1	56-590-65/4A	02114
L1	COIL, FIXED	2	1131-37	14632
L2	Same as L1			
MP1	COVER	1	20684-2	14632
R1	RESISTOR, VARIABLE, COMPOSITION: 10 kΩ, 10%, 1/2W	2	RV5NAYSD103A	81349
R2	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	CB2225	01121
R3	Same as R1			
R4	RESISTOR, FIXED, COMPOSITION: 82 kΩ, 5%, 1/4W	1	CB8235	01121

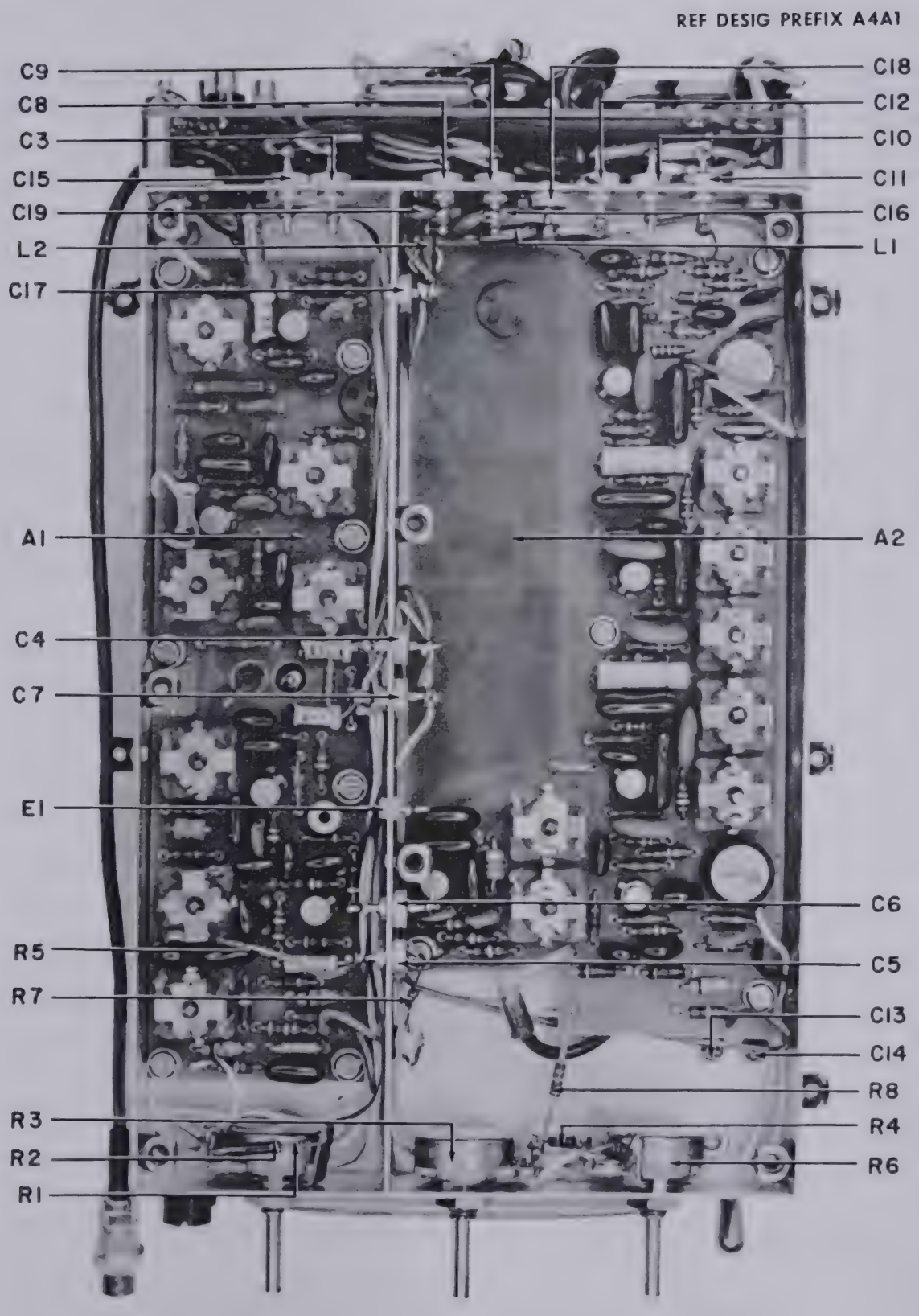


Figure 5-19. Type 8121 IF Amplifier, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R5	RESISTOR, FIXED, COMPOSITION: 5.1 Ω, 5%, 1/4W	1	CB51G5	01121
R6	RESISTOR, VARIABLE, COMPOSITION: 100 kΩ, 10%, 1/2W	1	RV5NAYSD104A	81349
R7*	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	CB1535	01121
R8*	RESISTOR, FIXED, COMPOSITION: 62 kΩ, 5%, 1/4W	1	CB6235	01121
R9	RESISTOR, FIXED, COMPOSITION: 2 kΩ, 5%, 1/4W	1	CB2025	01121
XY1	SOCKET, CRYSTAL	1	8000AG-3	91506
Y1	CRYSTAL, QUARTZ: 2.205 MHz	1	CR-18/U	81349

* Nominal value. Final value is factory selected.

5.4.5.2 Type 13748 IF Board No. 1 REF DESIG PREFIX A4A1A1

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	2	SM(.001 μF, GMV)	91418
C2	CAPACITOR, CERAMIC, TUBULAR: 1.5 pF, ±.1 pF, 500V	2	301-000-COKO-159B	72982
C3	Same as C1			
C4	CAPACITOR, DIPPED MICA: 75 pF, 5%, 500V	2	DM10-750J	72136
C5	CAPACITOR, DIPPED MICA: 180 pF, 5%, 500V	2	DM10-181J	72136
C6	CAPACITOR, CERAMIC, DISC: .005 μF, 20%, 50V	4	40C172A5	56289
C7	CAPACITOR, DIPPED MICA: 10 pF, 5%, 500V	1	DM10-100J	72136
C8	CAPACITOR, DIPPED MICA: 47 pF, 5%, 500V	2	DM10-470J	72136
C9	CAPACITOR, DIPPED MICA: 470 pF, 500V	1	DM15-471J	72136
C10	Same asC2			
C11	Same as C6			
C12	Same as C4			
C13	Same as C5			
C14	Same as C6			
C15	CAPACITOR, CERAMIC, TUBULAR: 6.2 pF, +.5 pF, 500V	1	301-000-COHO-629D	72982
C16	CAPACITOR, DIPPED MICA: 51 pF, 5%, 500V	1	DM10-510J	72136
C17	CAPACITOR, DIPPED MICA: 270 pF, 5%, 500V	1	CM05F271J03	81349
C18	Same as C8			
C19	CAPACITOR, DIPPED MICA: 240 pF, 5%, 500V	1	DM15-241J	72136
C20	Same as C6			
C21	CAPACITOR, COMPOSITION, TUBULAR: 0.68 pF, 10%, 500V	1	QC(.68 pF, 10%)	95121
C22	CAPACITOR, DIPPED MICA: 330 pF, 5%, 100V	1	DM10-331J	72136
C23	CAPACITOR, DIPPED MICA: 910 pF, 5%, 100V	1	DM15-911J	72136
C24	NOT USED			
C25	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μF, 20%, 30V	1	MTP106M030P1A	37942
C26	CAPACITOR, DIPPED MICA: 100 pF, 5%, 500V	1	DM10-101J	72136
C27	CAPACITOR, DIPPED MICA: 82 pF, 5%, 500V	1	DM10-820J	72136
C28	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μF, 10%, 35V	1	105D105X9035A2	56289
C29	CAPACITOR, DIPPED MICA: 330 pF, 5%, 500V	1	DM15-331J	72136
C30	CAPACITOR, DIPPED MICA: 120 pF, 5%, 500V	1	DM10-121J	72136
C31	CAPACITOR, CERAMIC, TUBULAR: 1.0 pF, ±.1 pF, 500V	1	301-000-COKO-109B	72982

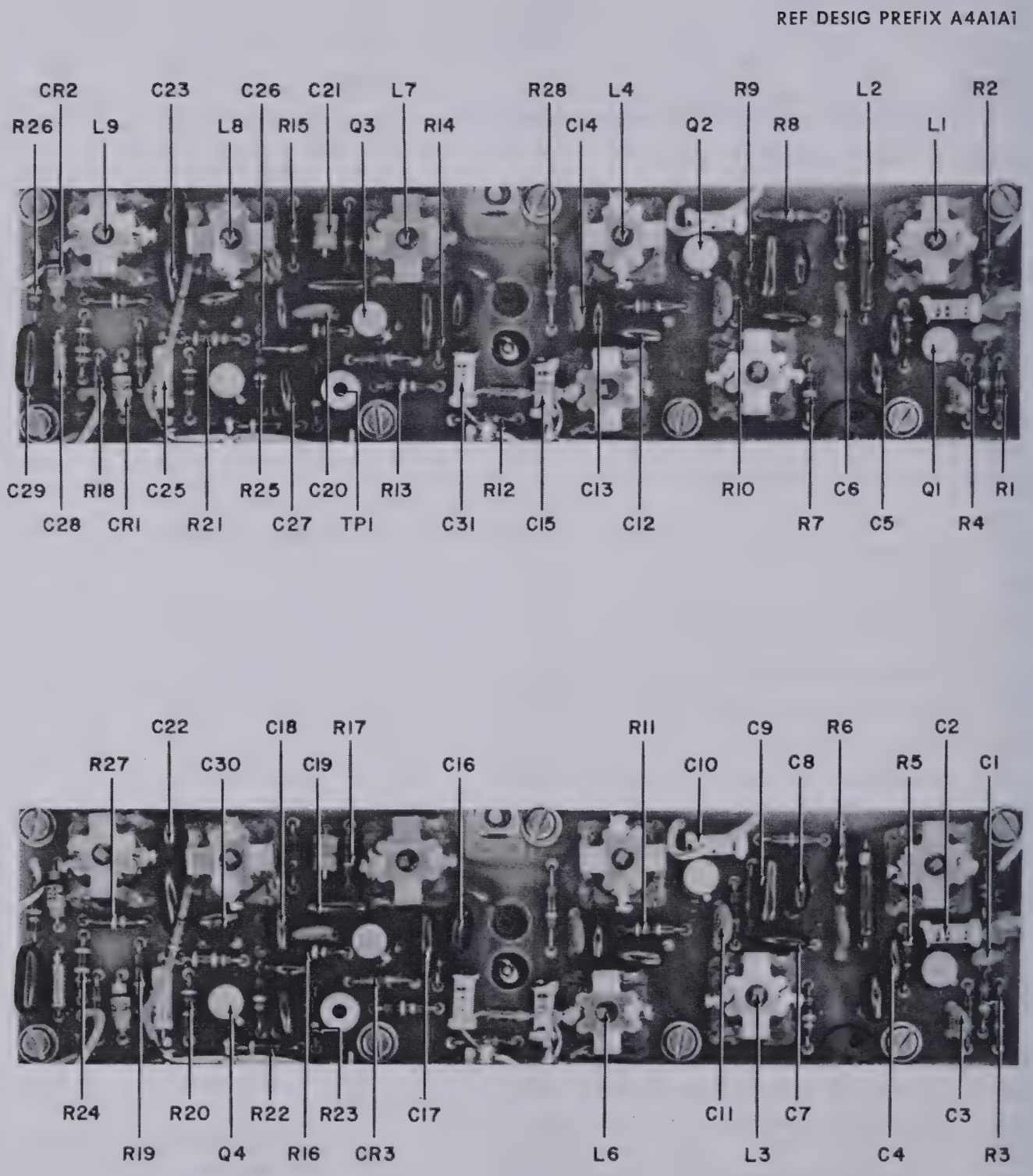


Figure 5-20. Type 13748 IF Amplifier Board No. 1, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
CR1	DIODE	1	1N759A	80131
CR2	DIODE, CAPACITOR	1	V27E	01281
CR3	DIODE	1	1N198	80131
L1	COIL, VARIABLE	4	30705-7	14632
L2	COIL, FIXED	1	1131-37	14632
L3	Same as L1			
L4	Same as L1			
L5	NOT USED			
L6	Same as L1			
L7	COIL, VARIABLE	2	30705-9	14632
L8	Same as L7			
L9	COIL, VARIABLE	1	30705-18	14632
Q1	TRANSISTOR	3	2N3478	80131
Q2	Same as Q1			
Q3	TRANSISTOR	1	3N128	80131
Q4	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 51 Ω, 5%, 1/4W	1	CB5105	01121
R2	RESISTOR, FIXED, COMPOSITION: 27 k, 5%, 1/4W	2	CB2235	01121
R3	RESISTOR, FIXED, COMPOSITION: 5.1 k, 5%, 1/4W	3	CB5125	01121
R4	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/4W	3	CB2225	01121
R5	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	3	CB4705	01121
R6	Same as R4			
R7	RESISTOR, FIXED, COMPOSITION: 10 k, 5%, 1/4W	1	CB1035	01121
R8	Same as R2			
R9	Same as R3			
R10	Same as R4			
R11	Same as R5			
R12	RESISTOR, FIXED, COMPOSITION: 22 k, 5%, 1/4W	1	CB2235	01121
R13	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	3	CB1045	01121

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R14	RESISTOR, FIXED, COMPOSITION: 2 k, 5%, 1/4W	1	CB2025	01121
R15	RESISTOR, FIXED, COMPOSITION: 10 M 5%, 1/4W	1	CB1065	01121
R16	Same as R13			
R17	RESISTOR, FIXED, COMPOSITION: 1 k, 5%, 1/4W	2	CB1025	01121
R18	Same as R3			
R19	Same as R17			
R20	Same as R5			
R21	RESISTOR, FIXED, COMPOSITION: 47 k, 5%, 1/4W	2	CB4735	01121
R22	RESISTOR, FIXED, COMPOSITION: 4.7 k, 5%, 1/4W	1	CB4725	01121
R23	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	CB2205	01121
R24	Same as R21			
R25	Same as R13			
R26	RESISTOR, FIXED, COMPOSITION: 30 k, 5%, 1/4W	1	CB3035	01121
R27	RESISTOR, FIXED, COMPOSITION: 220 k, 5%, 1/4W	1	CB2245	01121
R28	RESISTOR, FIXED, COMPOSITION: 620 Ω, 5%, 1/4W	1	CB6215	01121
TP1	TEST POINT	1	TJ358W	99687

5.4.5.3 Type 13750 IF Amplifier Board No. 2 REF DESIG PREFIX A4A1A2

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, DIPPED MICA: 240 pF, 5%, 500V	1	DM15-241J	72136
C2	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 50V	2	19C214A6	56289
C3	CAPACITOR, COMPOSITION, TUBULAR: 0.68 pF, 10%, 500V	1	QC(.68 pF, 10%)	95121
C4	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 50V	1	40C172A5	56289
C5	CAPACITOR, DIPPED MICA: 330 pF, 5%, 500V	1	DM15-331J	72136
C6	CAPACITOR, DIPPED MICA: 910 pF, 5%, 100V	1	DM15-911J	72136
C7	CAPACITOR, DIPPED MICA: 1800 pF, 1%, 500V	3	DM19-182F	72136
C8	CAPACITOR, CERAMIC, DISC: 0.05 μF, 20%, 50V	5	55C23A1	56289
C9	CAPACITOR, DIPPED MICA: 10 pF, 5%, 500V	3	DM10-100J	72136
C10	Same as C8			
C11	CAPACITOR, DIPPED MICA: 2000 pF, 1%, 500V	2	DM19-202F	72136
C12	CAPACITOR, MYLAR, TUBULAR: 0.022 μF, 10%, 100V	2	663UW-223-9-1-W	26655
C13	Same as C7			
C14	Same as C8			
C15	Same as C9			
C16	Same as C8			
C17	Same as C11			
C18	Same as C12			
C19	Same as C7			
C20	Same as C8			
C21	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μF, 10%, 35V	1	150D105X9035A2	56289
C22	CAPACITOR, DIPPED MICA: 270 pF, 5%, 500V	2	DM15-271J	72136
C23	Same as C22			
C24	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 200V	2	8131-026-Z5U0-103M	72982
C25	Same as C24			
C26	CAPACITOR, DIPPED MICA: 100 pF, 5%, 500V	5	DM10-101J	72136
C27	Same as C26			
C28	Same as C9			
C29	Same as C2			
C30	Same as C26			
C31	Same as C26			
C32	Same as C26			
CR1	DIODE	4	1N198	80131

REF DESIG PREFIX A4A1A2

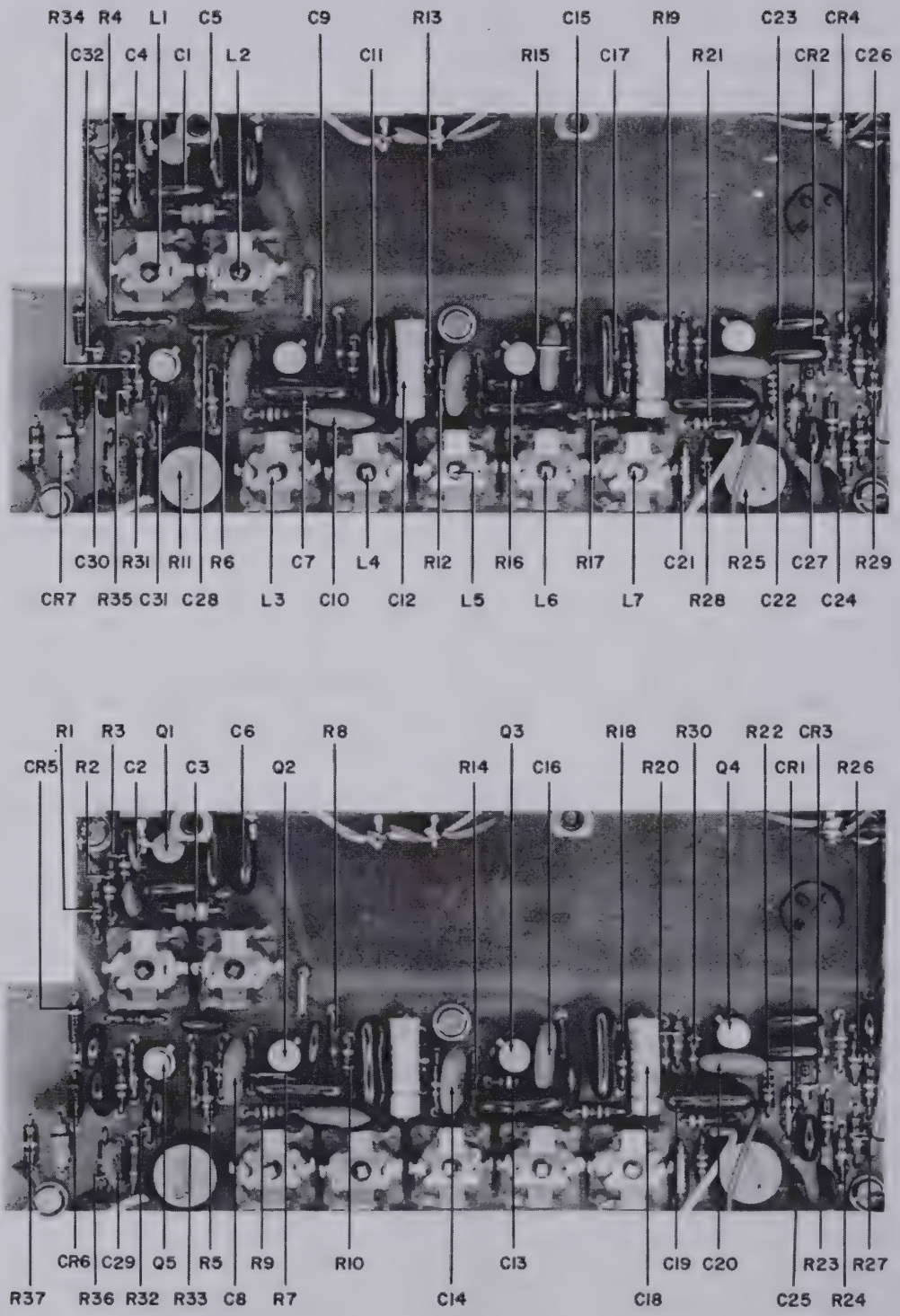


Figure 5-21. Type 13750 IF Amplifier Board No. 2, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	DIODE	1	1N462A	80131
CR6	DIODE	1	1N754A	80131
CR7	DIODE	1	1N759A	80131
L1	COIL, VARIABLE	2	30705-9	14632
L2	Same as L1			
L3	COIL, VARIABLE	5	30705-4	14632
L4	Same as L3			
L5	Same as L3			
L6	Same as L3			
L7	Same as L3			
Q1	TRANSISTOR	3	2N3478	80131
Q2	Same as Q1			
Q3	Same as Q1			
Q4	TRANSISTOR	1	2N3933	80131
Q5	TRANSISTOR	1	2N706	80131
R1	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	CB1045	01121
R2	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	5	CB1035	01121
R3	Same as R2			
R4	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	3	CB1025	01121
R5	RESISTOR, FIXED, COMPOSITION 75 kΩ, 5%, 1/4W	1	CB7535	01121
R6	Same as R2			
R7	RESISTOR, FIXED, COMPOSITION: 5.1 k, 5%, 1/4W	4	CB5125	01121
R8	RESISTOR, FIXED, COMPOSITION: 2.7 k, 5%, 1/4W	2	CB2725	01121
R9	RESISTOR, FIXED, COMPOSITION: 39 k, 5%, 1/4W	2	CB3935	01121
R10	RESISTOR, FIXED, COMPOSITION: 36 kΩ, 5%, 1/4W	2	CB3635	01121
R11	RESISTOR, VARIABLE, FILM: 50 kΩ, 10%, 3/4W	2	150(50k, 10%)	75042

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R12	RESISTOR, FIXED, COMPOSITION: 51 kΩ, 5%, 1/4W	2	CB5135	01121
R13	Same as R2			
R14	Same as R7			
R15	Same as R8			
R16	Same as R9			
R17	Same as R10			
R18	Same as R12			
R19	Same as R7			
R20	RESISTOR, FIXED, COMPOSITION: 510 Ω, 5%, 1/4W	1	CB5115	01121
R21	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	CB3325	01121
R22	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	CB3335	01121
R23	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	2	CB2245	01121
R24	RESISTOR, FIXED, COMPOSITION: 200 kΩ, 5%, 1/4W	1	CB2045	01121
R25	Same as R11			
R26	Same as R23			
R27	Same as R1			
R28	RESISTOR, FIXED, COMPOSITION: 240 kΩ, 5%, 1/4W	1	CB2445	01121
R29	Same as R1			
R30	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	CB4705	01121
R31	Same as R4			
R32	Same as R4			
R33	Same as R7			
R34	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/4W	1	CB2225	01121
R35	RESISTOR, FIXED, COMPOSITION: 510 k, 5%, 1/4W	2	CB5145	01121
R36	Same as R35			
R37	Same as R2			

5.4.5.4 Type 11280-6 10 MHz Oscillator

REF DESIG PREFIX A4A1A3

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500V	1	FA5C-102W	01121
C2	CAPACITOR, COMPOSITION, TUBULAR: 0.43 pF, 10%, 500V	1	QC(.43 pF 10%)	95121
C3	CAPACITOR, DIPPED MICA: 43 pF, 5%, 500V	1	DM10-430J	72136
C4	CAPACITOR, DIPPED MICA: 68 pF, 5%, 500V	1	DM10-680J	72136
C5	CAPACITOR, DIPPED MICA: 470 pF, 5%, 500V	1	DM15-471J	72136
E1	TERMINAL, INSULATED	1	SFU-16	04013
Q1	TRANSISTOR	1	2N706	80131
R1	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	CB1035	01121
R2	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	1	CB4745	01121
Y1	CRYSTAL, QUARTZ: 10.000 MHz	1	CR-64/U	81349

REF DESIG PREFIX A4A1A3

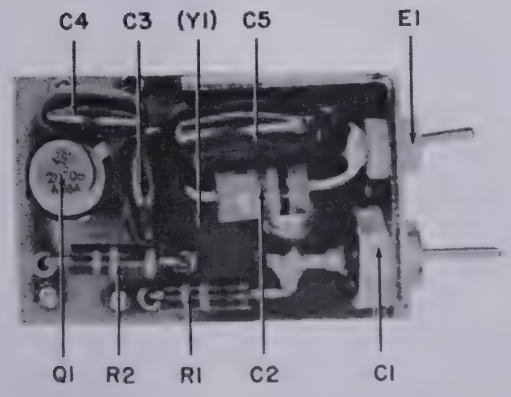


Figure 5-22. Type 11280-6 10-MHz Oscillator, Component Locations

5.4.5.5 Type 8229 Sweep Generator & Horizontal Amplifier REF DESIG PREFIX A4A2

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 1μF, 10%, 35V	1	150D105X9035A2	56289
C2	CAPACITOR, ELECTROLTYIC, TANTALUM: 47 μF, 10%, 20V	1	150D476X9020R2	56289
C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μF, 10%, 35V	1	150D475X9035B2	56289
CR1	NOT USED			
CR2	NOT USED			
CR3	NOT USED			
CR4	DIODE	1	1N462A	80131
Q1	TRANSISTOR	1	2N2646	80131
Q2	TRANSISTOR	2	2N3251	80131
Q3	TRANSISTOR	3	2N929	80131
Q4	NOT USED			
Q5	Same as Q3			
Q6	NOT USED			
Q7	NOT USED			
Q8	TRANSISTOR	2	2N3440	80131
Q9	TRANSISTOR	2	2N2270	80131
Q10	Same as Q9			
Q11	Same as Q3			
Q12	Same as Q2			
Q13	Same as Q8			
R1	RESISTOR, FIXED, COMPOSITION: 3 k, 5%, 1/4W	1	CB3025	01121
R2	RESISTOR, FIXED, COMPOSITION: 2 k, 5%, 1/4W	1	CB2025	01121
R3	RESISTOR, FIXED, COMPOSITION: 1 k, 5%, 1/4W	1	CB1025	01121
R4	RESISTOR, FIXED, COMPOSITION: 4.7 k, 5%, 1/4W	1	CB4725	01121
R5	RESISTOR, FIXED, COMPOSITION: 13 k, 5%, 1/4W	3	CB1335	01121
R6	RESISTOR, FIXED, COMPOSITION: 22 k, 5%, 1/4W	4	CB2235	01121
R7	RESISTOR, FIXED, COMPOSITION: 24 k, 5%, 1/4W	1	CB2435	01121

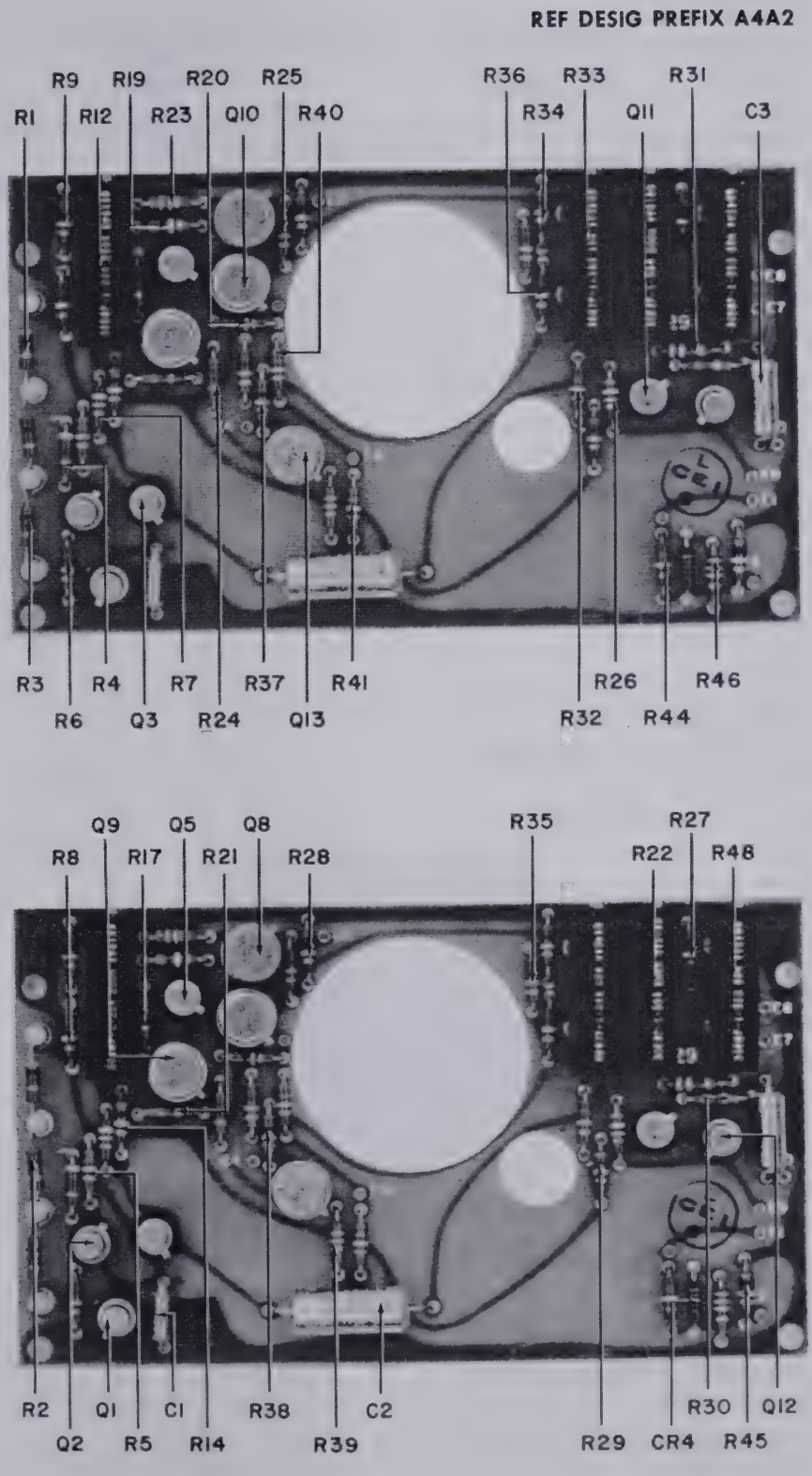


Figure 5-23. Type 8229 Sweep Generator and Horizontal Amplifier, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R8	RESISTOR, FIXED, COMPOSITION: 220 k, 5%, 1/4W	1	CB2245	01121
R9	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	4	CB1045	01121
R10	NOT USED			
R11	NOT USED			
R12	RESISTOR, VARIABLE, METAL-GLAZE: 200 k, 10%, 3/4W	1	3068P-1-204	80294
R13	NOT USED			
R14	Same as R9			
R15	NOT USED			
R16	NOT USED			
R17	RESISTOR, FIXED, COMPOSITION: 10 M, 5%, 1/4W	1	CB1065	01121
R18	NOT USED			
R19	Same as R9			
R20	RESISTOR, FIXED, COMPOSITION: 200 k, 5%, 1/4W	2	CB2045	01121
R21	RESISTOR, FIXED, COMPOSITION: 5.1 k, 5%, 1/4W	1	CB5125	01121
R22	RESISTOR, VARIABLE, METAL-GLAZE: 500 kΩ, 10%, 3/4W	1	3068P-1-504	80294
R23	Same as R5			
R24	RESISTOR, FIXED, COMPOSITION: 7.5 k, 5%, 1/4W	1	CB7525	01121
R25	RESISTOR, FIXED, COMPOSITION: 20 k, 5%, 1/4W	1	CB2035	01121
R26	RESISTOR, FIXED, COMPOSITION: 390 k, 5%, 1/4W	1	CB3945	01121
R27	RESISTOR, FIXED, COMPOSITION: 150 k, 5%, 1/4W	1	CB1545	01121
R28	RESISTOR, FIXED, COMPOSITION: 10 k, 5%, 1/4W	3	CB1035	01121
R29	Same as R28			
R30	RESISTOR, FIXED, COMPOSITION: 2.7 k, 5%, 1/4W	1	CB2725	01121
R31	RESISTOR, FIXED, COMPOSITION: 3.3 k, 5%, 1/4W	1	CB3325	01121

5.4.5.6 Type 12688 Focus & Intensity Control REF DESIG PREFIX A4A3

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, CERAMIC, DISC: .05 μF, 20%, 500V	1	33C17A	56289
R1	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	1	CB1045	01121
R2	RESISTOR, VARIABLE, COMPOSITION: 500 k, 1/4W	1	70-09172	76055
R3	RESISTOR, FIXED, COMPOSITION: 3.3 M, 5%, 1/2W	1	EB3355	01121
R4	RESISTOR, VARIABLE, COMPOSITION: 2.5 M, 1/4W	1	70-09173	76055
R5	RESISTOR, FIXED, COMPOSITION: 3.9 M, 5%, 1/2W	1	EB-3955	01121
R6	RESISTOR, FIXED, COMPOSITION: 4.7 M, 5%, 1/2W	1	EB-4755	01121

REF DESIG PREFIX A4A3

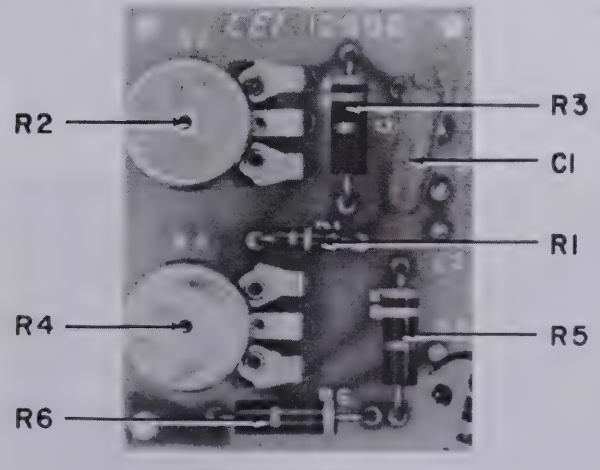


Figure 5-24. Type 12688 Focus and Intensity Control, Component Locations

5.4.6 Type 76118A -12V Regulated Power Supply REF DESIG PREFIX A5

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 200 μF, -10+75%, 50V	1	39D207G050FJ4	56289
C2	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 50V	1	30D106G050CB2	56289
C3	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 25V	1	30D106G025BB2	56289
C4	CAPACITOR, DIPPED MICA: 200 pF, 5%, 500V	1	CM05F201J03	81349
C5	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μF, 10%, 20V	1	150D476X9020R2	56289
CR1	DIODE	1	MDA950A-3	04713
CR2	DIODE	1	1N754A	80131
CR3	DIODE	1	1N462A	80131
Q1	TRANSISTOR	1	2N3055	80131
Q2	TRANSISTOR	3	2N4037	80131
Q3	Same as Q2			
Q4	Same as Q2			
R1	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	CB4715	01121
R2	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	2	CB6825	01121
R3	Same as R2			
R4	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	1	CB1545	01121
R5	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	2	CB2225	01121
R6	RESISTOR, VARIABLE, FILM: 1 kΩ, 30%, 1/2W	1	62PAR1K	73138
R7	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	CB3925	01121
R8	Same as R5			
R9	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	1	CB2215	01121
R10	Same as R5			

REF DESIG PREFIX A5

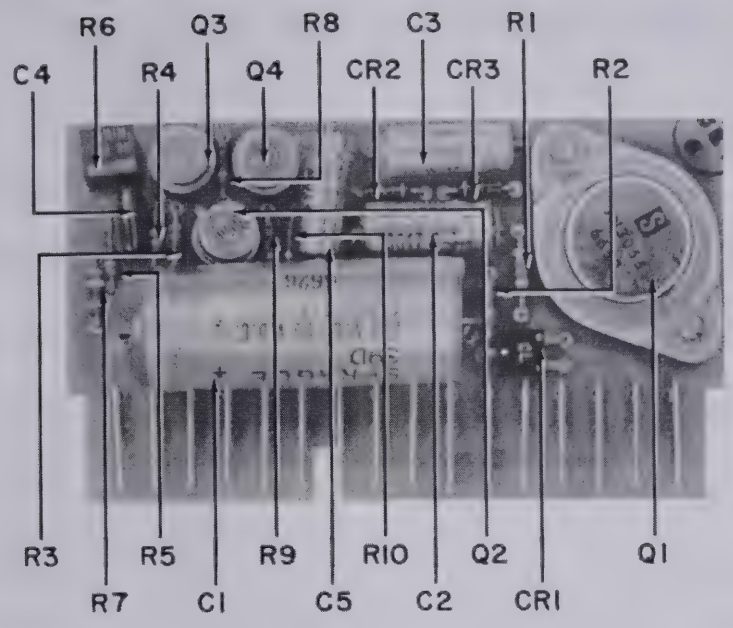


Figure 5-25. Type 76118A -12V Regulated Power Supply, Component Locations

REF DESIG PREFIX A6

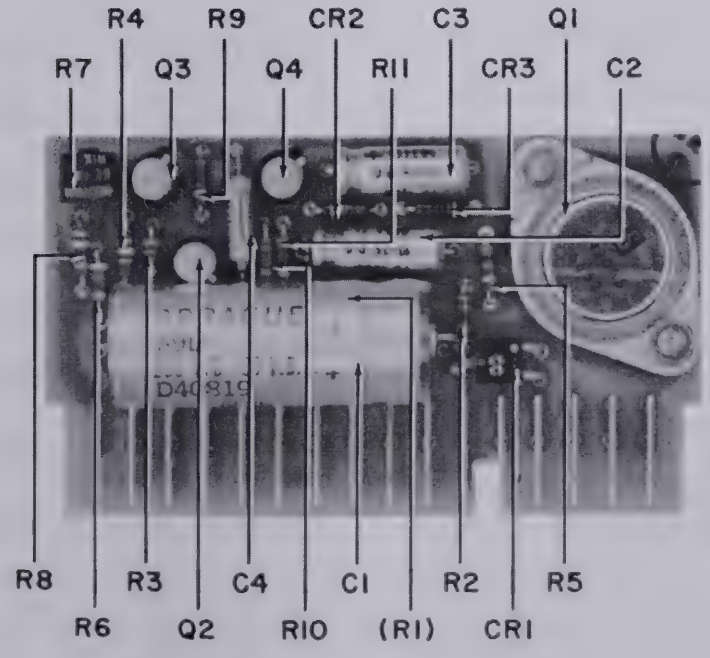


Figure 5-26. Type 76121A +24V Regulated Power Supply, Component Locations

5.4.7 Type 76121A +24V Regulated Power Supply REF DESIG PREFIX A6

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 200 μF, -10+75%, 50V	1	39D207G050FJ4	56289
C2	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 50V	1	30D106G050CB2	56289
C3	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 25V	1	30D106G025BB2	56289
C4	CAPACITOR, ELECTROLYTIC, ALUMINUM: 6.8 μF, 10%, 35V	1	150D685X9035B2	56289
CR1	DIODE	1	MDA940A-3	04713
CR2	DIODE	1	1N754A	80131
CR3	DIODE	1	1N462A	80131
Q1	TRANSISTOR	1	2N3055	80131
Q2	TRANSISTOR	3	2N4074	80131
Q3	Same as Q2			
Q4	Same as Q2			
R1	RESISTOR, FIXED, COMPOSITION: 47Ω, 5%, 1/4W	1	CB4705	01121
R2	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	2	CB6825	01121
R3	Same as R2			
R4	RESISTOR, FIXED, COMPOSITION: 270 kΩ, 5%, 1/4W	1	CB2745	01121
R5	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	CB1025	01121
R6	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RC07GF103J	81349
R7	RESISTOR, VARIABLE, FILM: 1 kΩ, 30%, 1/2W	1	62PAR1K	73138
R8	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	CB3925	01121
R9	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	1	CB1525	01121
R10	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	1	CB2215	01121
R11	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	CB8225	01121

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R32	RESISTOR, FIXED, COMPOSITION: 27 k, 5%, 1/4W	1	CB2735	01121
R33	RESISTOR, VARIABLE, W-W, 10 k, 5%, 1W	1	3067P-1-103	80294
R34	Same as R28			
R35	Same as R6			
R36	Same as R6			
R37	Same as R6			
R38	Same as R20			
R39	Same as R5			
R40	RESISTOR, FIXED, COMPOSITION: 180 k, 5%, 1/4W	2	CB1845	01121
R41	Same as R40			
R42	NOT USED			
R43	NOT USED			
R44	RESISTOR, FIXED, COMPOSITION: 270 k, 5%, 1/4W	1	CB2745	01121
R45	Same as R9			
R46*	RESISTOR, FIXED, COMPOSITION: 330 k, 5%, 1/4W	1	CB3345	01121
R47	NOT USED			
R48	RESISTOR, VARIABLE, METAL-GLAZE: 50 k, 10%, 3/4W	1	3068P-1-503	80294

* Nominal value. Final value factory selected.

5.4.8 Type 76123 +18V Regulated Power Supply (0-250 MA) REF DESIG PREFIX A7

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 200 μF, -10+75%, 50V	1	39D207G050FJ4	56289
C2	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 50V	1	30D106G050CB2	56289
C3	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 25V	1	30D106G025BB2	56289
C4	CAPACITOR, ELECTROLYTIC, ALUMINUM: 15 μF, 10%, 20V	1	CS13BE156K	81349
CR1	DIODE	1	MDA940A-3	04713
CR3	DIODE	1	1N754A	80131
CR3	DIODE	1	1N462A	80131
Q1	TRANSISTOR	1	2N3055	80131
Q2	TRANSISTOR	3	2N4074	80131
Q3	Same as Q2			
Q4	Same as Q2			
R1	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	CB4705	01121
R2	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	2	CB6825	01121
R3	Same as R2			
R4	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	1	CB2245	01121
R5	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	CB1025	01121
R6	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	CB5625	01121
R7	RESISTOR, VARIABLE, FILM: 1 kΩ, 30%, 1/2W	1	62PAR1K	73138
R8	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	CB3925	01121
R9	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	CB1825	01121
R10	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	1	CB2215	01121
R11	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	CB4725	01121

REF DESIG PREFIX A7

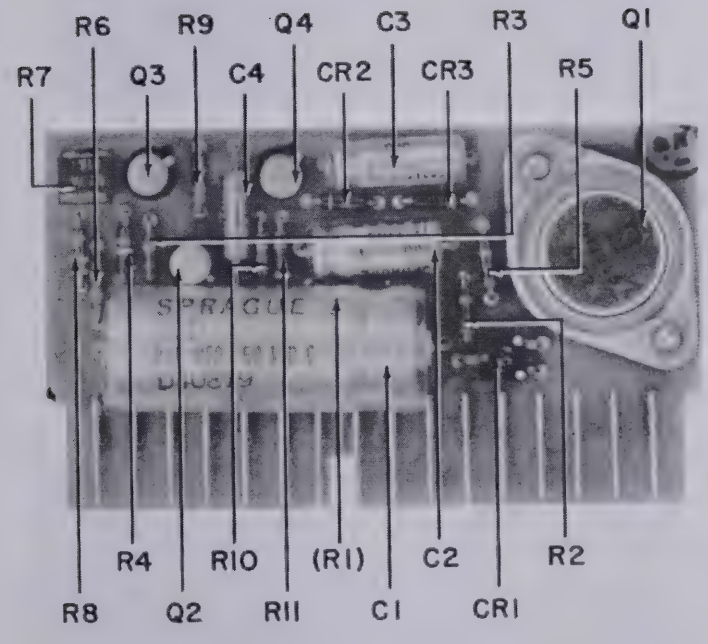


Figure 5-27. Type 76123 +18V Regulated Power Supply, Component Locations

5.4.9 Type 7338 Video Amplifier REF DESIG PREFIX A8

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 10%, 35V	1	150D225X9035B2	56289
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μF, 10%, 35V	3	150D105X9035A2	56289
C3	CAPACITOR, ELECTROLTYIC, TANTALUM: 22 μF, 10%, 35V	1	150D226X9035R2	56289
C4	Same as C2			
C5	Same as C2			
C6	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 μF, 10%, 20V	1	150D107X9020S2	56289
CR1	DIODE	4	1N462A	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
Q1	TRANSISTOR	1	2N4074	80131
Q2	TRANSISTOR	1	2N3251	80131
Q3	TRANSISTOR	1	2N2270	80131
Q4	TRANSISTOR	1	2N4037	80131
R1	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	CB4715	01121
R2	RESISTOR, FIXED, FILM: 191 kΩ, 1%, 1/4W	1	RN60D1913F	81349
R3	RESISTOR, FIXED, FILM: 24.3 kΩ, 1%, 1/4W	1	RN60D2432F	81349
R4	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	CB1025	01121
R5	RESISTOR, FIXED, FILM: 681 Ω, 1%, 1/4W	1	RN60D6810F	81349
R6	RESISTOR, FIXED, FILM: 4.75 kΩ, 1%, 1/4W	1	RN60D4751F	81349
R7	RESISTOR, FIXED, COMPOSITON: 47 Ω, 5%, 1/4W	3	CB4705	01121
R8	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	CB1015	01121
R9	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1.4W	2	CB1525	01121
R10	Same as R9			
R11	Same as R7			
R12	Same as R7			
R13	RESISTOR, FIXED, COMPOSITION: 75 Ω, 5%, 1/4W	1	CB7505	01121
R14	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	CB1035	01121

REF DESIG PREFIX A8

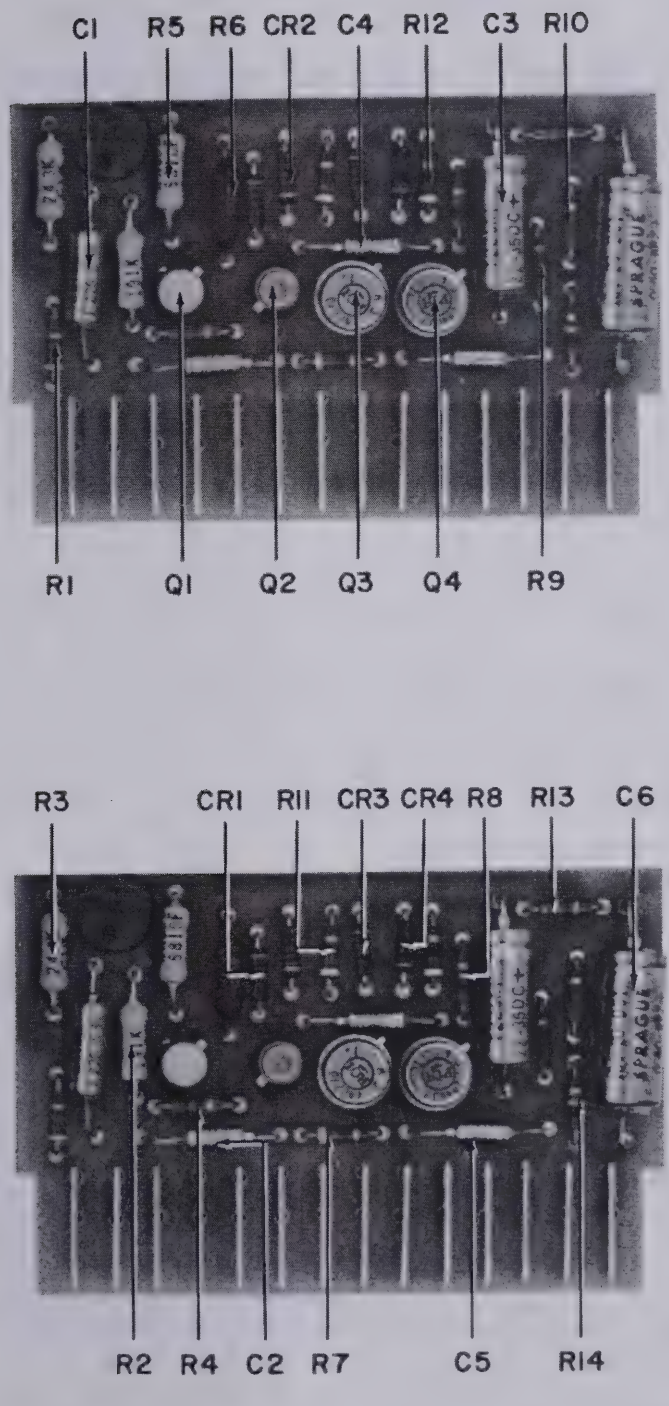


Figure 5-28. Type 7338 Video Amplifier, Component Locations

5.4.10 Type 7424 Audio Amplifier REF DESIG PREFIX A9

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.1 μF, 10%, 35V	1	150D104X9035A2	56289
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 10%, 15V	1	150D226X9015B2	56289
C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 μF, 10%, 20V	1	150D107X9020S2	56289
C4	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μF, 10%, 35V	1	150D105X9035A2	56289
CR1	DIODE	4	1N462A	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
Q1	TRANSISTOR	1	2N4074	80131
Q2	TRANSISTOR	1	2N3251	80131
Q3	TRANSISTOR	1	2N2270	80131
Q4	TRANSISTOR	1	2N4037	80131
R1	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	CB4715	01121
R2	RESISTOR, FIXED, FILM: 332 kΩ, 1%, 1/4W	1	RN60D3323F	81349
R3	RESISTOR, FIXED, FILM 24.3 kΩ, 1%, 1/4W	1	RN60D2432F	81349
R4	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	CB2225	01121
R5	RESISTOR, FIXED, FILM: 681 Ω, 1%, 1/4W	1	RN60D6810F	81349
R6	RESISTOR, FIXED, COMPOSITION: 2.7 Ω, 5%, 1/4W	1	CB27G5	01121
R7	RESISTOR, FIXED, FILM: 10 kΩ, 1%, 1/4W	1	RN60D1002F	81349
R8	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	CB1015	01121
R9	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	2	CB1525	01121
R10	Same as R9			
R11	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	CB4705	01121
R12	Same as R11			
R13	Same as R1			
T1	TRANSFORMER	1	14006	14632

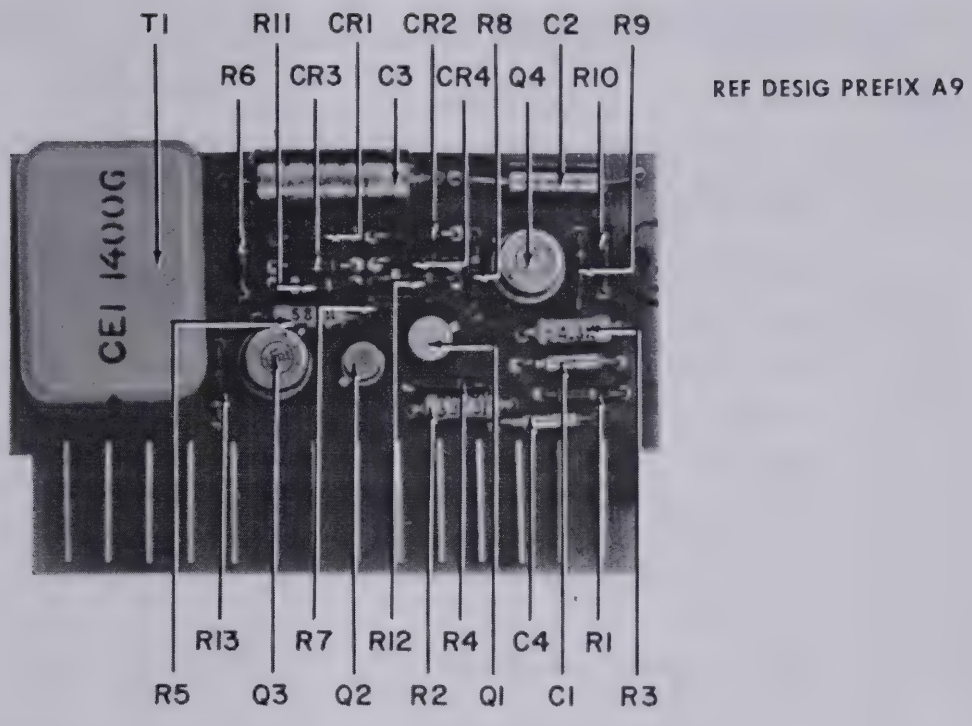


Figure 5-29. Type 7424 Audio Amplifier, Component Locations

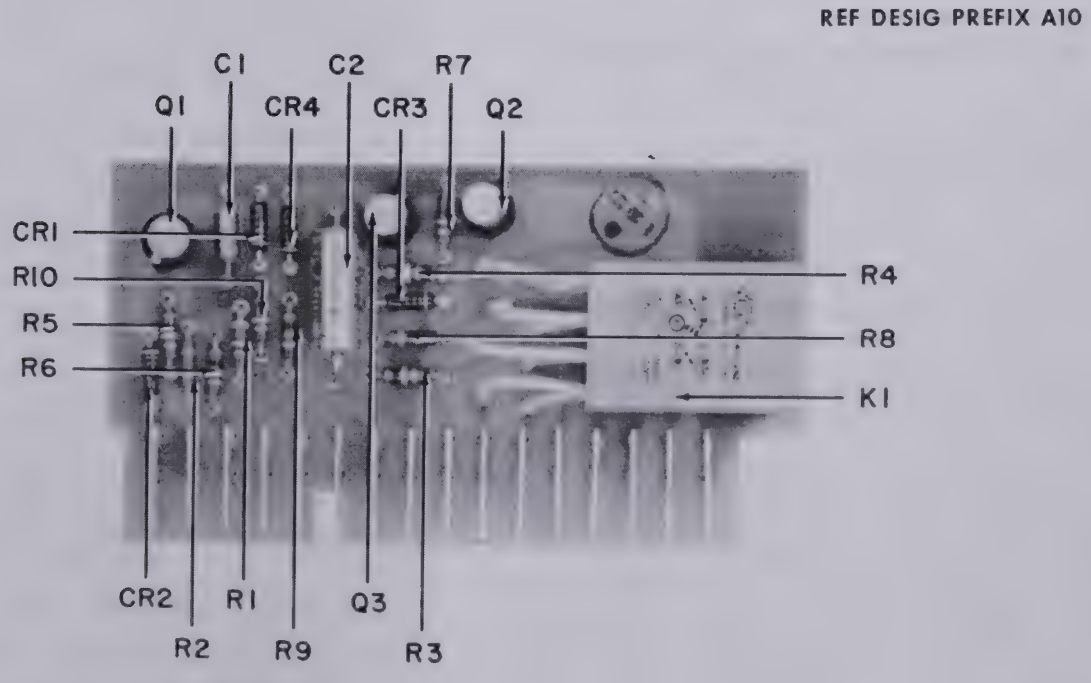


Figure 5-30. Type 7509 Carrier Operated Relay Module, Component Locations

5.4.11 Type 7509 Carrier Operated Relay REF DESIG PREFIX A10

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μF, 10%, 35V	1	150D105X9035A2	56289
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 10%, 35V	1	150D226X9035R2	56289
CR1	DIODE	4	1N462A	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
K1	RELAY	1	71GB4R-3-A-2.5K	98927
Q1	TRANSISTOR	3	2N4074	80131
Q2	Same as Q1			
Q3	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	1	CB4745	01121
R2	RESISTOR, FIXED, COMPOSITION: 5.1 MΩ, 5%, 1/4W	1	CB5155	01121
R3	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	2	CB1045	01121
R4	Same as R3			
R5	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1.4W	2	CB1035	01121
R6	Same as R5			
R7	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	1	CB2235	01121
R8	RESISTOR, FIXED COMPOSITION: 1.3 kΩ, 5%, 1/4W	1	CB1325	01121
R9	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	CB1015	01121
R10	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	1	CB1545	01121

5.4.12 Type 79316 AGC Amplifier REF DESIG PREFIX A11

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 15 μF, 10%, 20V	1	150D156X9020B2	56289
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 3.3 μF, 10%, 35V	1	150D335X9035B2	56289
CR1	DIODE	5	1N462A	80131
CR2	DIODE	1	1N759A	80131
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
Q1	TRANSISTOR	6	2N4074	80131
Q2	Same as Q1			
Q3	TRANSISTOR	4	2N3251	80131
Q4	Same as Q1			
Q5	Same as Q1			
Q6	Same as Q3			
Q7	Same as Q1			
Q8	Same as Q3			
Q9	Same as Q3			
Q10	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 43 kΩ, 5%, 1/4W	1	CB4335	01121
R2	RESISTOR, FIXED, COMPOSITION: 62 kΩ, 5%, 1/4W	1	CB6235	01121
R3	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	CB1045	01121
R4	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	4	CB4735	01121
R5	Same as R4			
R6	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	2	CB2225	01121
R7	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	CB4725	01121
R8	RESISTOR, FIXED, COMPOSITION: 39 kΩ, 5%, 1/4W	1	CB3935	01121
R9	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	3	CB1035	01121

REF DESIG PREFIX A11

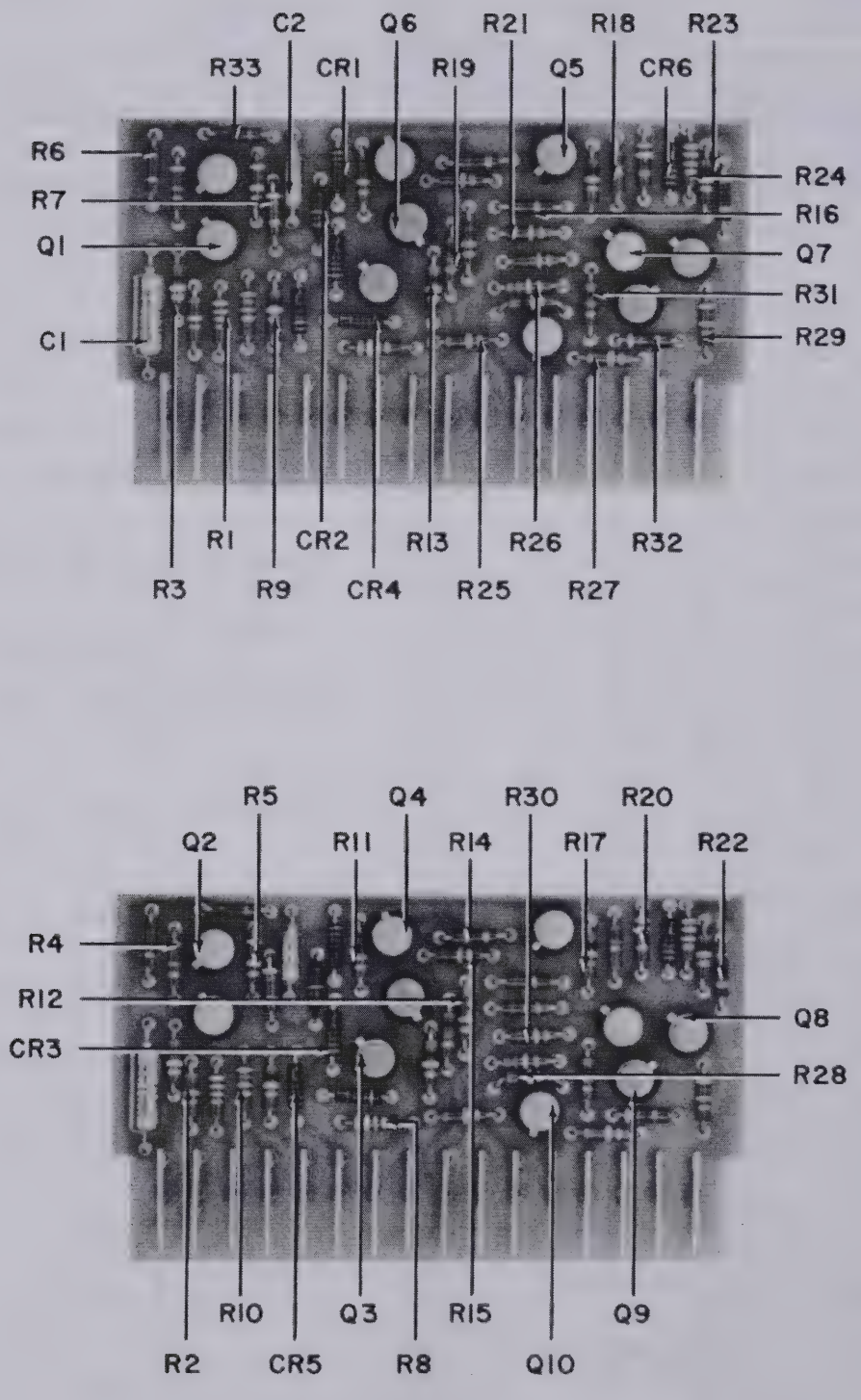


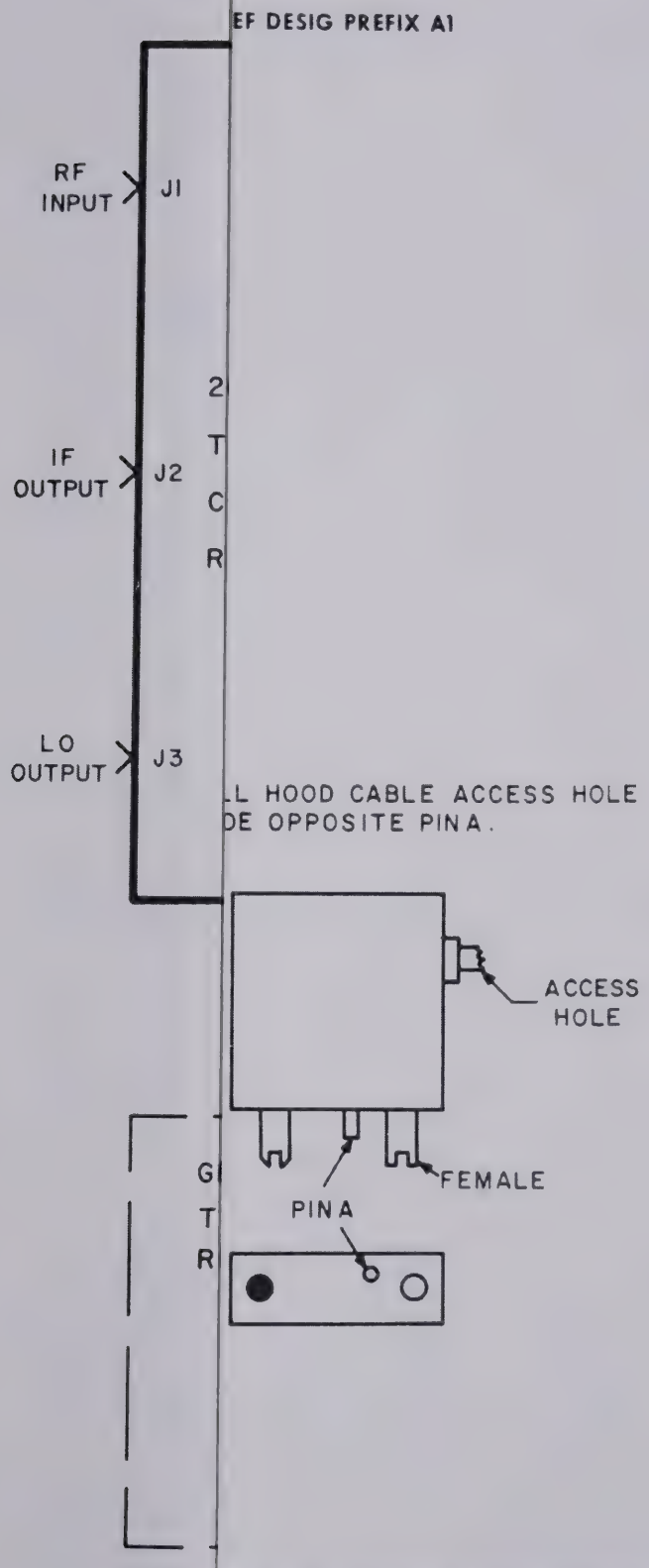
Figure 5-31. Type 79316 AGC Amplifier, Component Locations

Ref Desig	Description	Qty Per Assy	Vendor Part No.	Vendor Code
R10	Same as R4			
R11	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	5	CB2235	01121
R12	Same as R11			
R13	Same as R3			
R14	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/4W	1	CB5125	01121
R15	Same as R11			
R16	RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W	1	CB2725	01121
R17	Same as R9			
R18	RESISTOR, FIXED, COMPOSITION: 750 Ω, 5%, 1/4W	1	CB7515	01121
R19	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	CB1015	01121
R20	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	CB3925	01121
R21	Same as R11			
R22	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	1	CB1525	01121
R23	Same as R9			
R24	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	CB3335	01121
R25	RESISTOR, FIXED, COMPOSITION: 12 kΩ, 5%, 1/4W	2	CB1235	01121
R26	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	1	CB1845	01121
R27	Same as R25			
R28	Same as R3			
R29	Same as R4			
R30	Same as R11			
R31	Same as R19			
R32	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	CB4705	01121
R33	Same as R6			

SECTION VI

SCHEMATIC DIAGRAMS

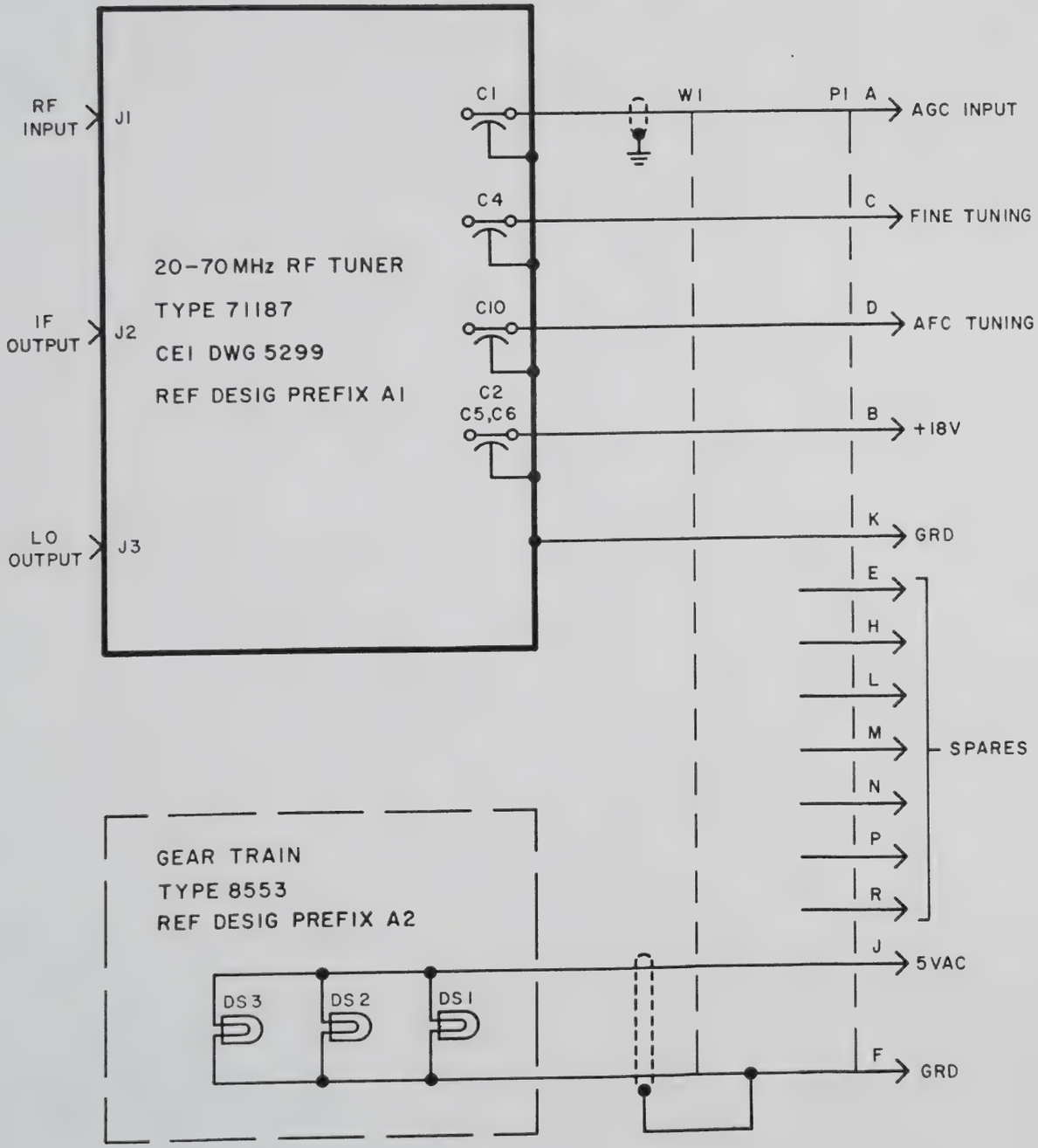
Figure 6-1



71207 20-70-MHz RF Tuner Assembly,
ematic Diagram

SECTION VI

SCHEMATIC DIAGRAMS



REF DESIG PREFIX A1

NOTES:
1. INSTALL HOOD CABLE ACCESS HOLE ON SIDE OPPOSITE PIN A.

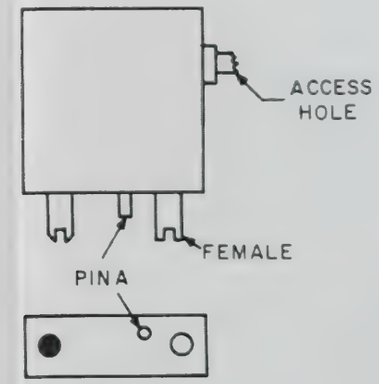
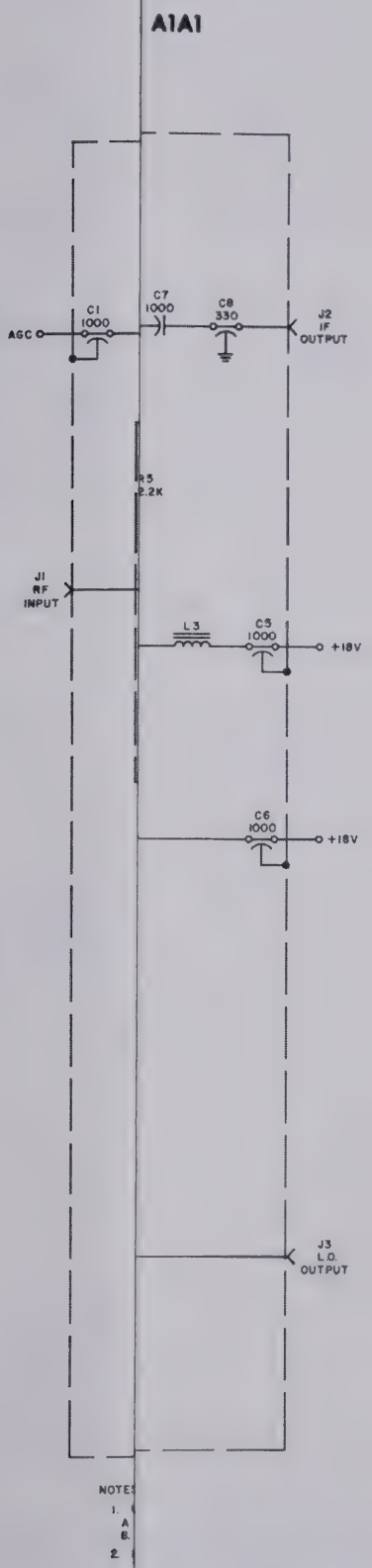


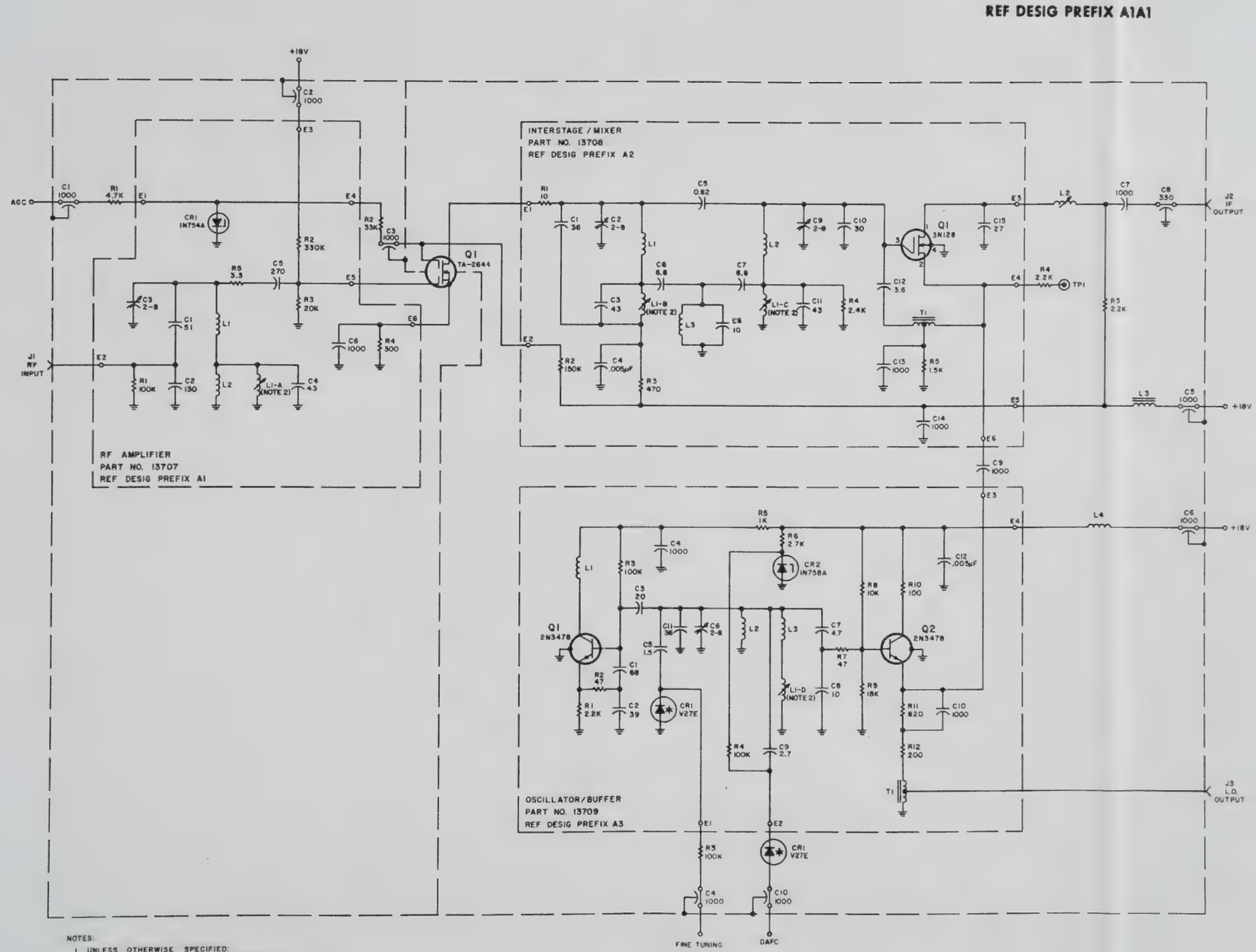
Figure 6-1. Type 71207 20-70-MHz RF Tuner Assembly, Schematic Diagram

Figure 6-2



NOTES
1.
A
B.
2.

)-70-MHz RF Tuner,
gram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4 W.
   B. CAPACITANCE IS MEASURED IN pF
2. L1-A THRU L1-D ARE GANGED SECTIONS OF INDUCTUNER L1. THE SECTIONS ARE NOT PHYSICALLY LOCATED ON, OR A PART OF, PRINTED CIRCUIT ASSEMBLIES A1—A3.

Figure 6-2. Type 71187 20-70-MHz RF Tuner, Schematic Diagram

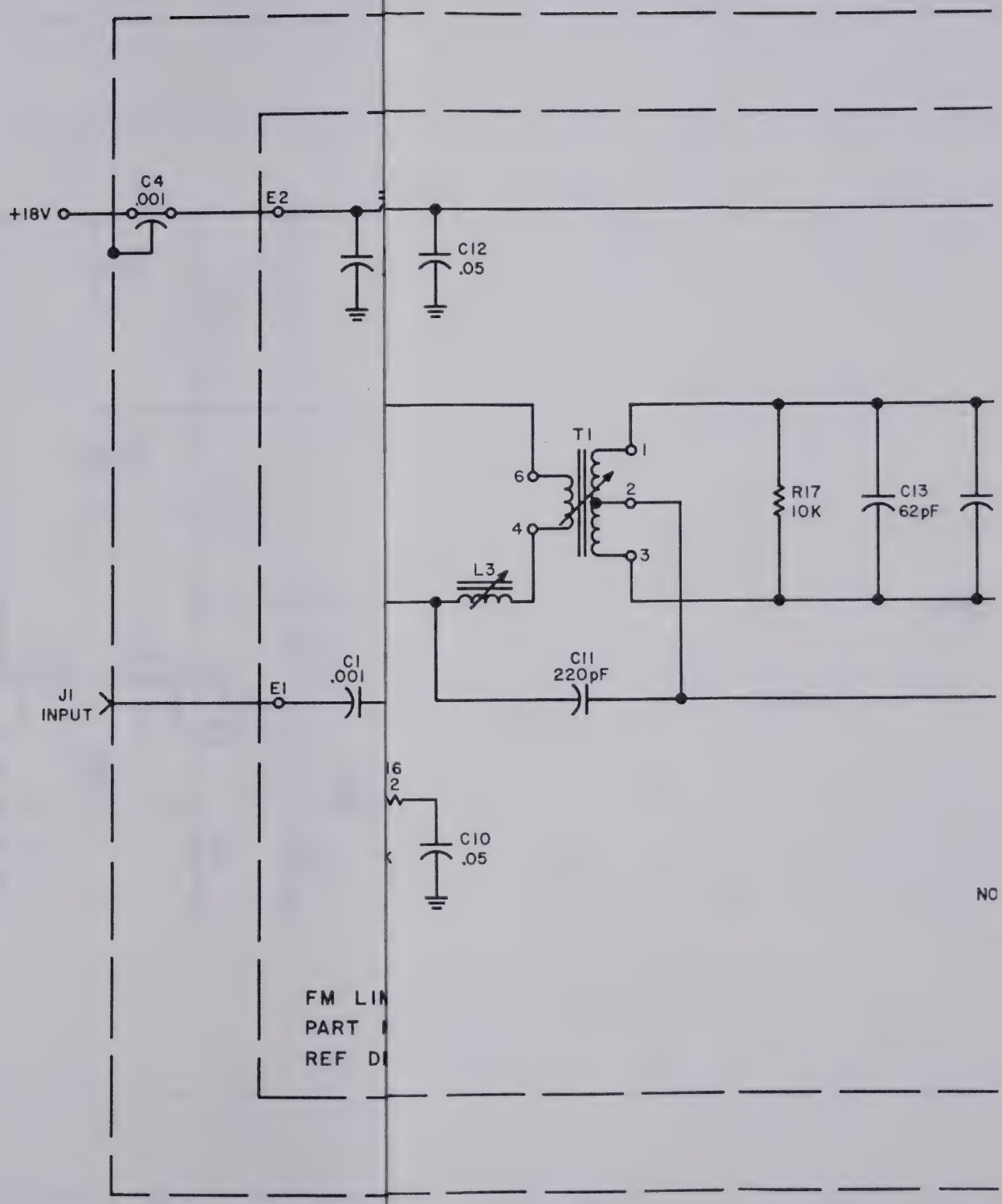

+18V
C4
.001
E2
C12
.05
T1
1
2
3
4
6
R17
10K
C13
62pF
L3
C11
220pF
J1
INPUT
E1
C1
.001
C10
.05
NO
FM LIN
PART
REF DI

Figure 6-3a

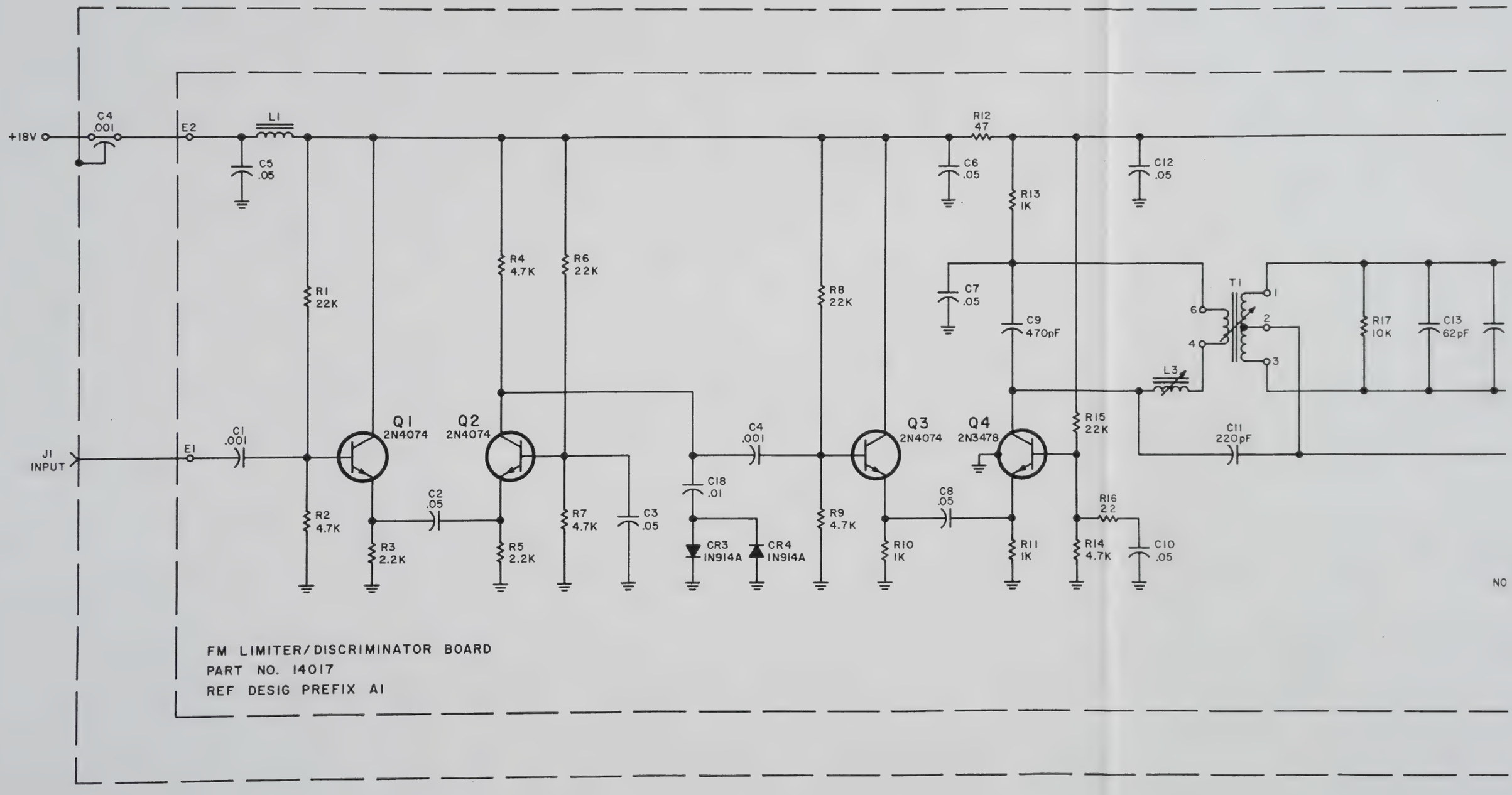


Figure 6-3a

6-7a

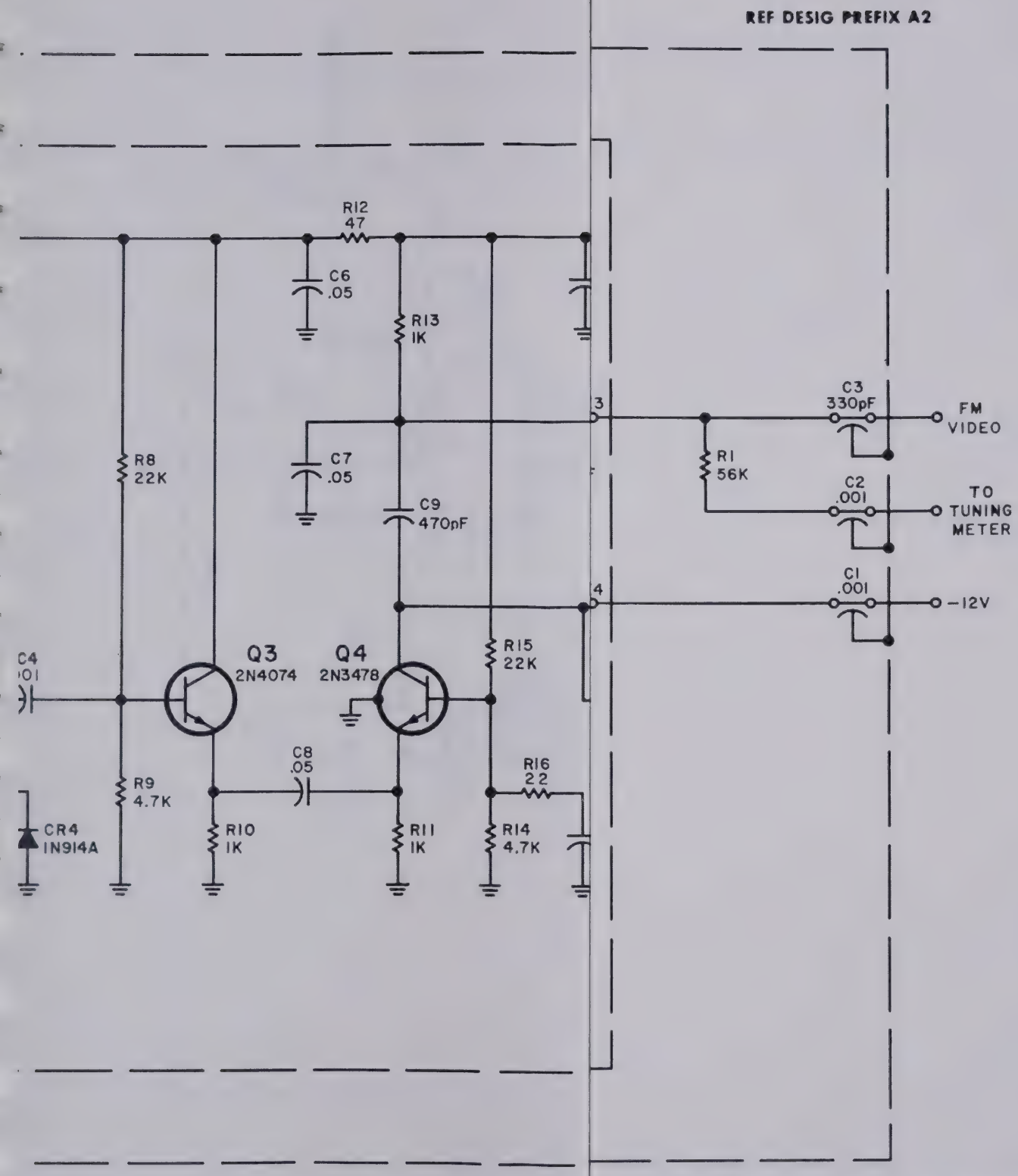
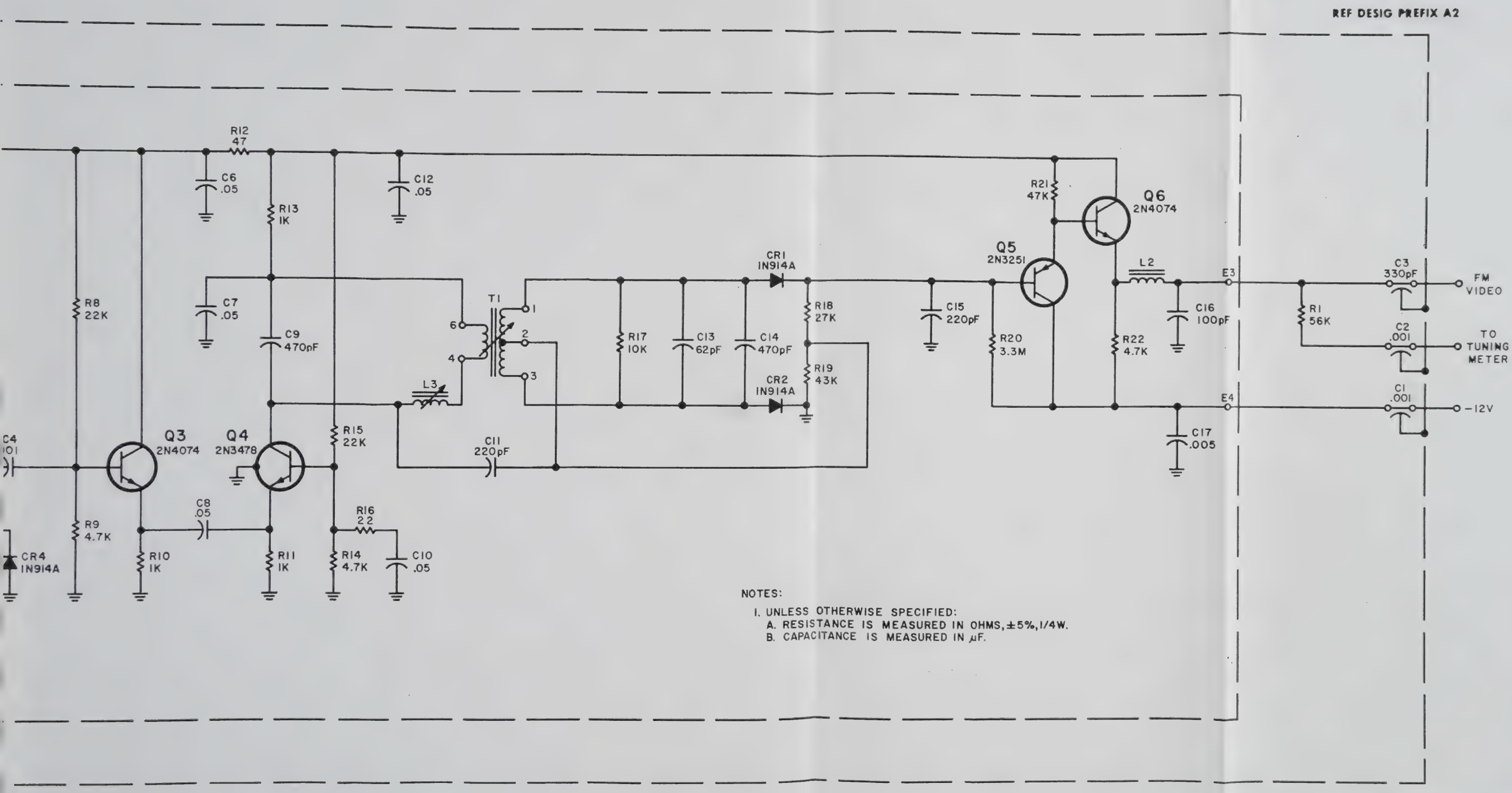


Figure 6-3. Type 79331 FM Limiter/Discriminator, Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   B. CAPACITANCE IS MEASURED IN μF.

Figure 6-3. Type 79331 FM Limiter/Discriminator, Schematic Diagram

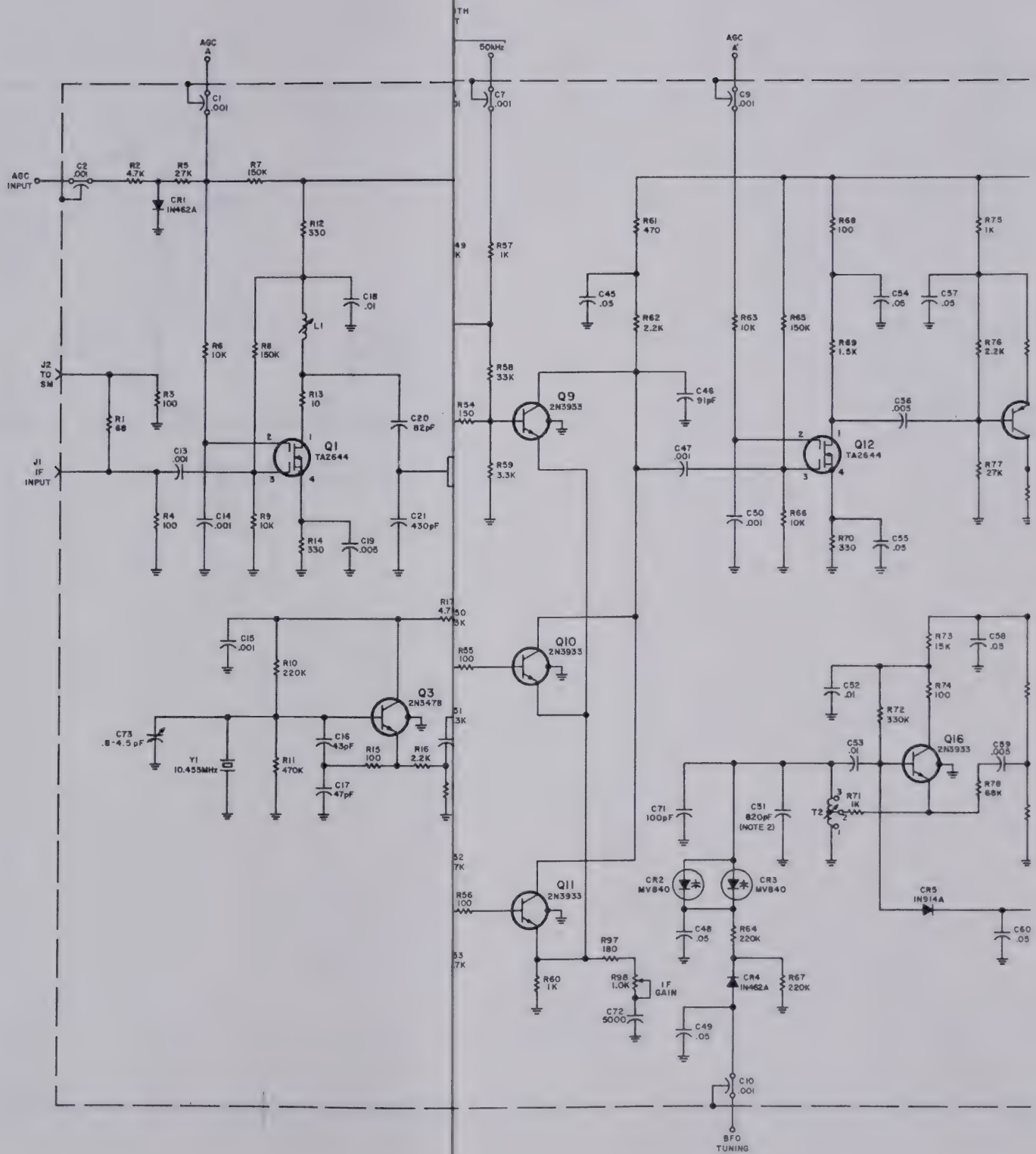


Figure 6-4a

6-9a

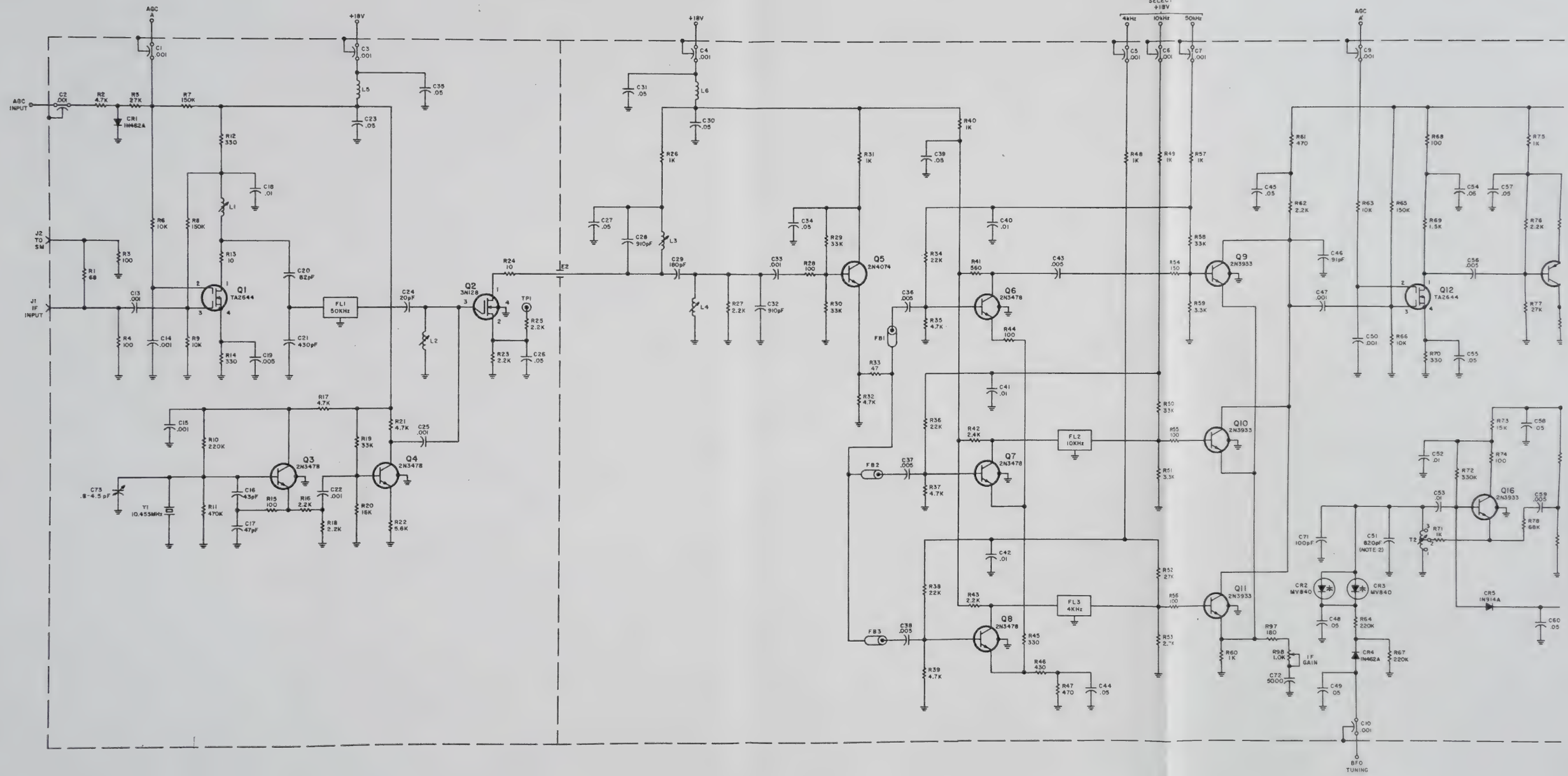


Figure 6-4a

6-9a

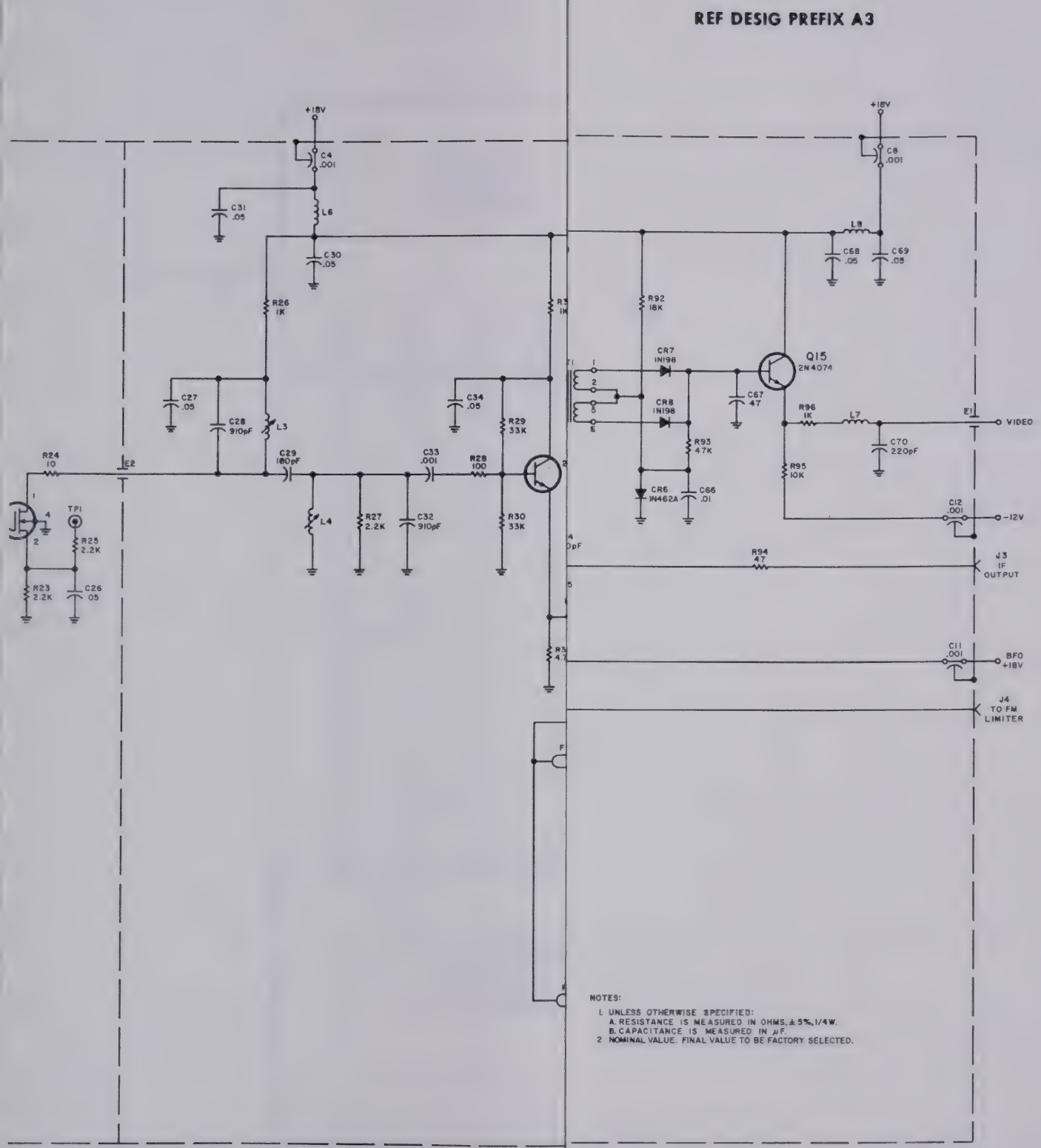
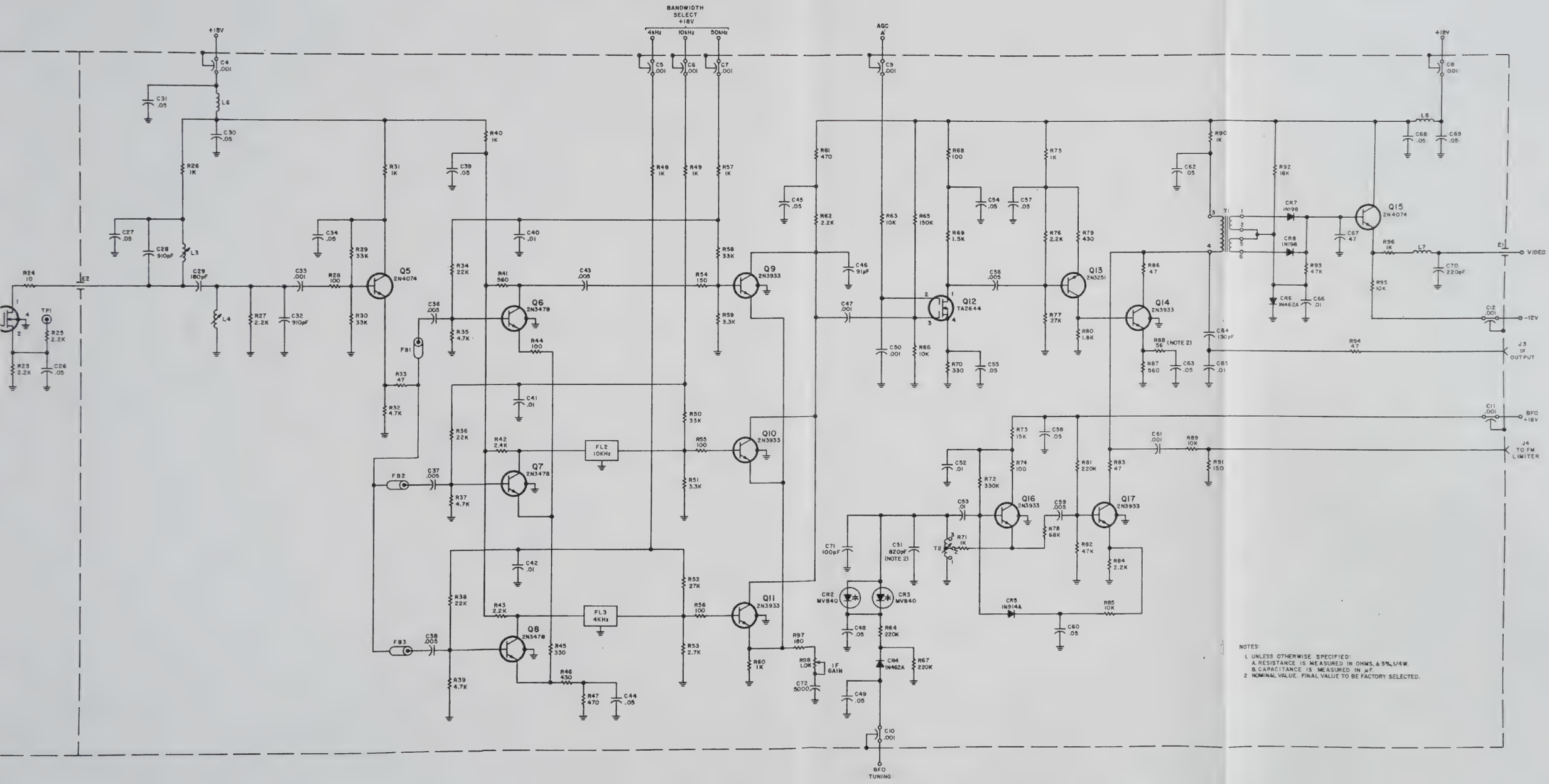


Figure 6-4. Type 72186 4/10/50-kHz IF Amplifier, Schematic Diagram

REF DESIG PREFIX A3



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, ± 5%, 1/4W.
   B. CAPACITANCE IS MEASURED IN μF.
2. NOMINAL VALUE. FINAL VALUE TO BE FACTORY SELECTED.

Figure 6-4. Type 72186 4/10/50-kHz IF Amplifier, Schematic Diagram

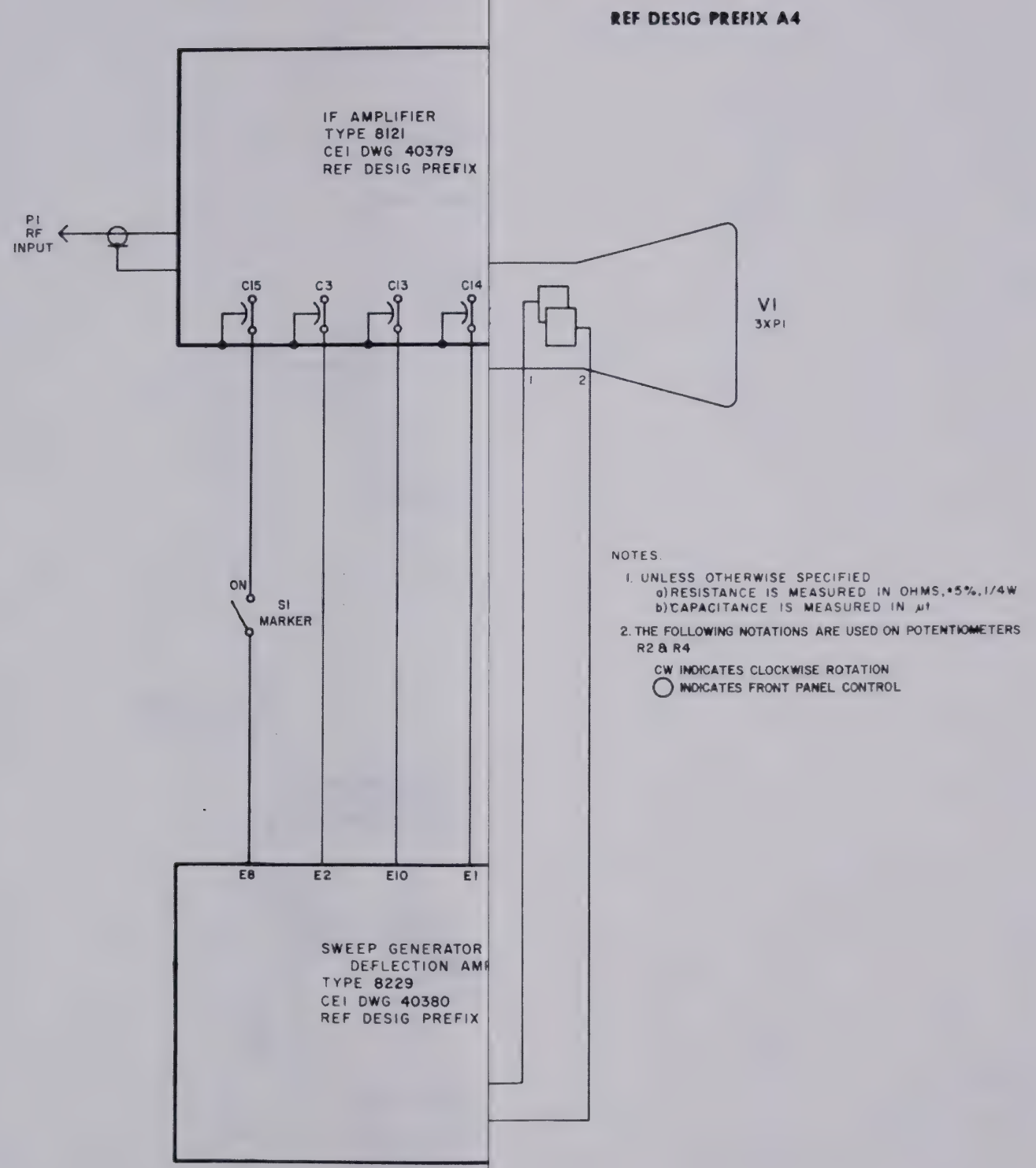


Figure 6-5. Type 79332 Signal Monitor, Main Chassis Schematic Diagram

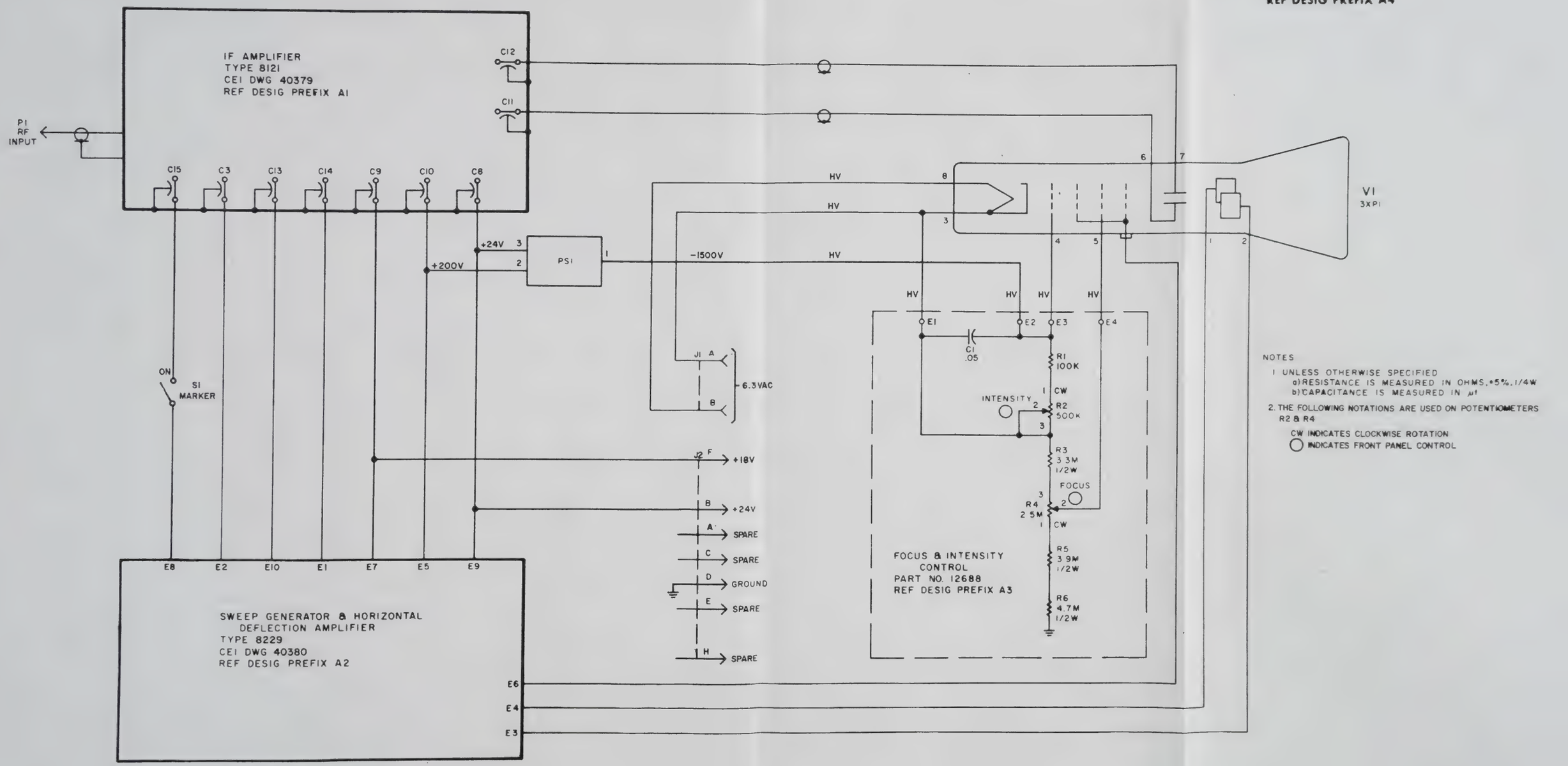


Figure 6-5. Type 79332 Signal Monitor, Main Chassis Schematic Diagram

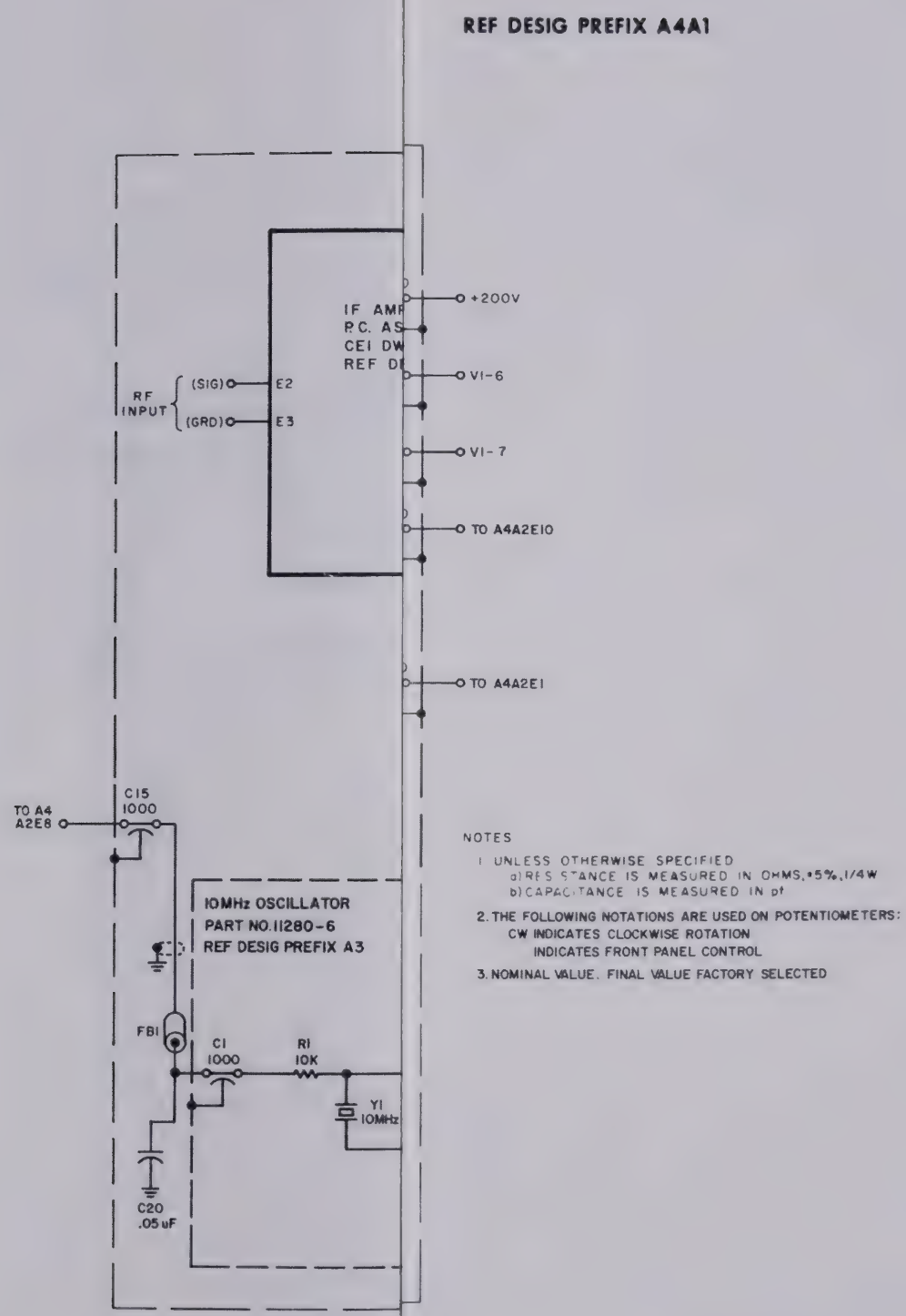
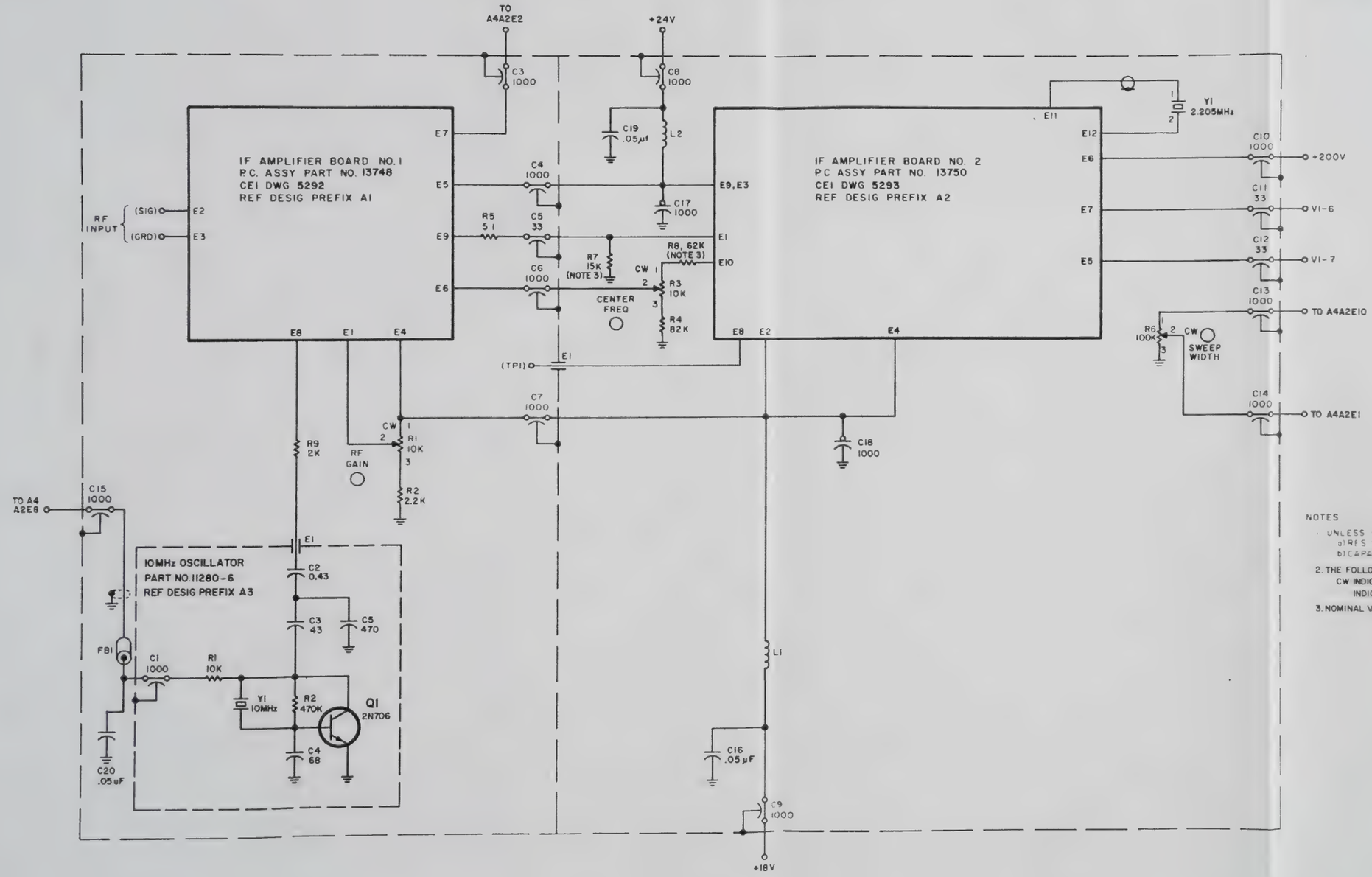


Figure 6-6. Type 8121 IF Amplifier, Schematic Diagram

REF DESIG PREFIX A4A1



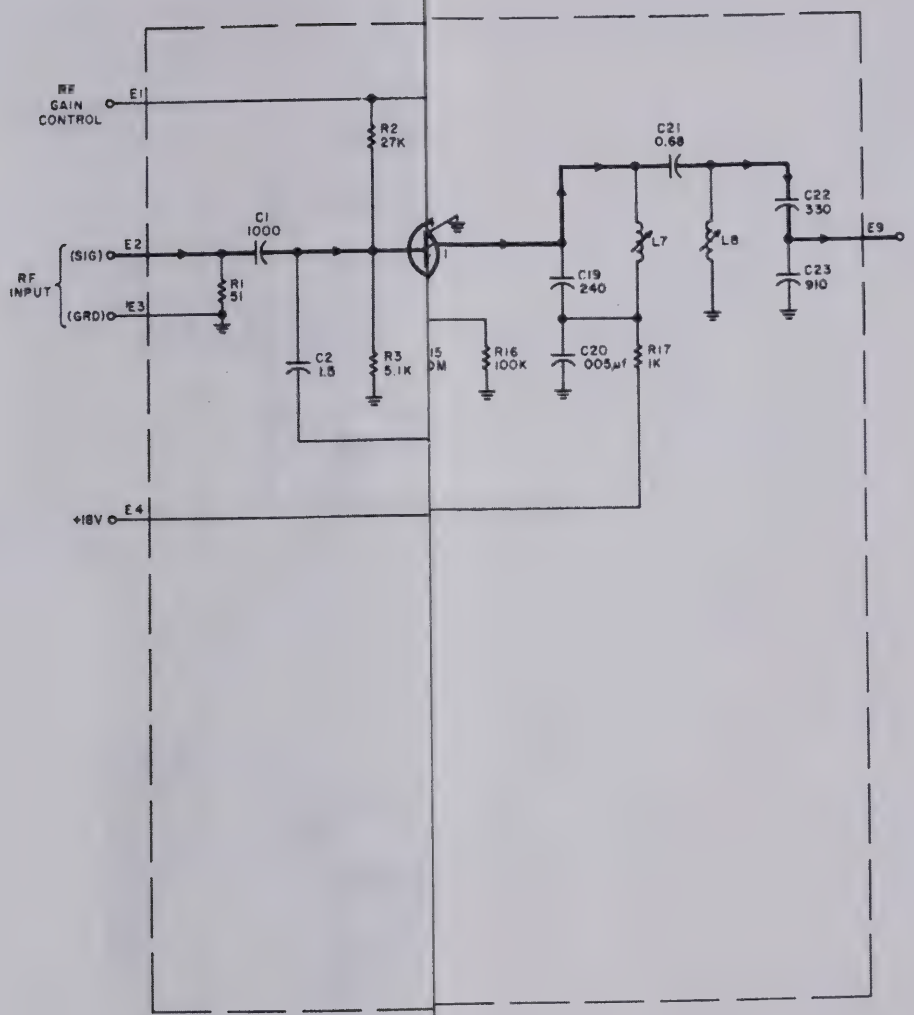
NOTES

1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN pf
2. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   CW INDICATES CLOCKWISE ROTATION
   INDICATES FRONT PANEL CONTROL
3. NOMINAL VALUE, FINAL VALUE FACTORY SELECTED

Figure 6-6. Type 8121 IF Amplifier, Schematic Diagram

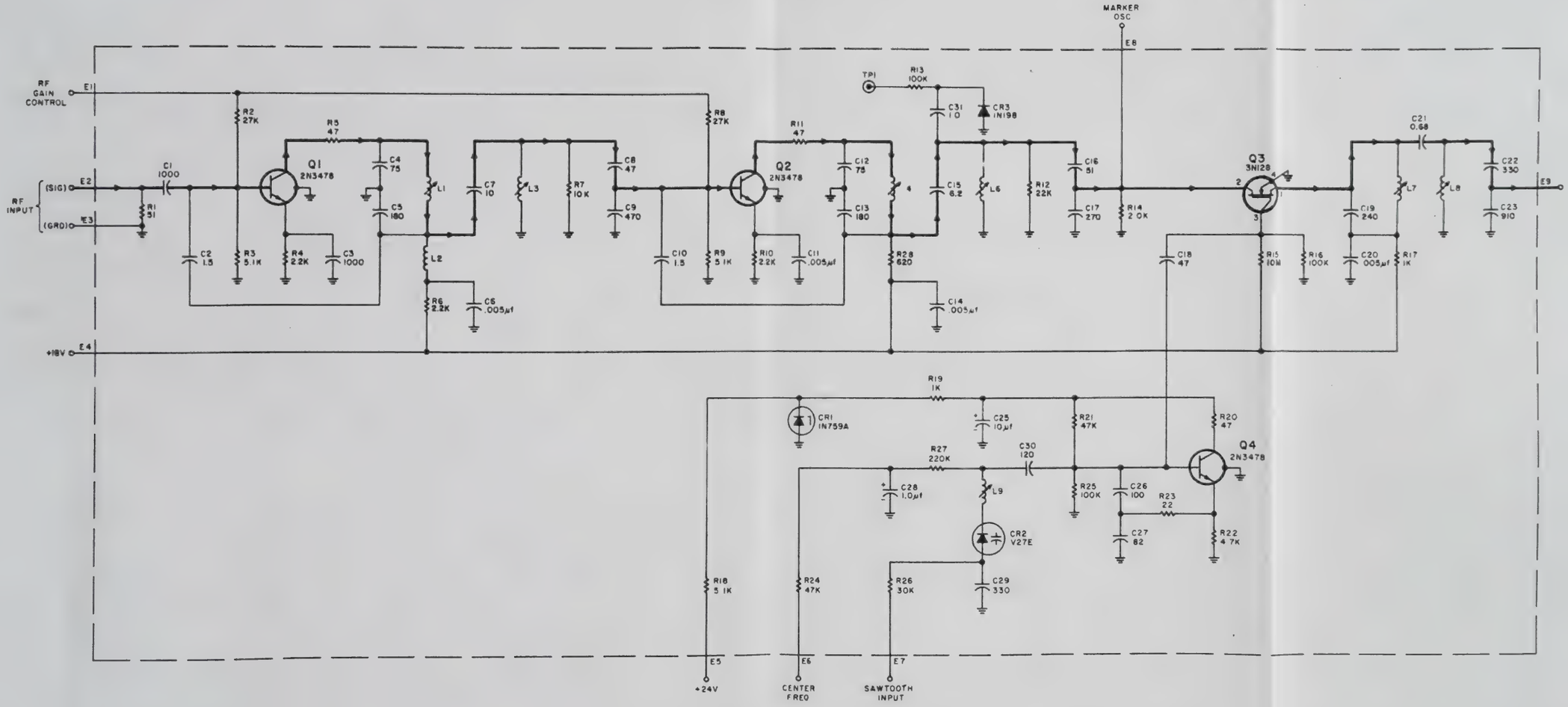
Figure 6-7

DESIG PREFIX A4A1A1



6-7. Type 13748 IF Amplifier Board No. 1, Schematic Diagram

REF DESIG PREFIX A4A1A1



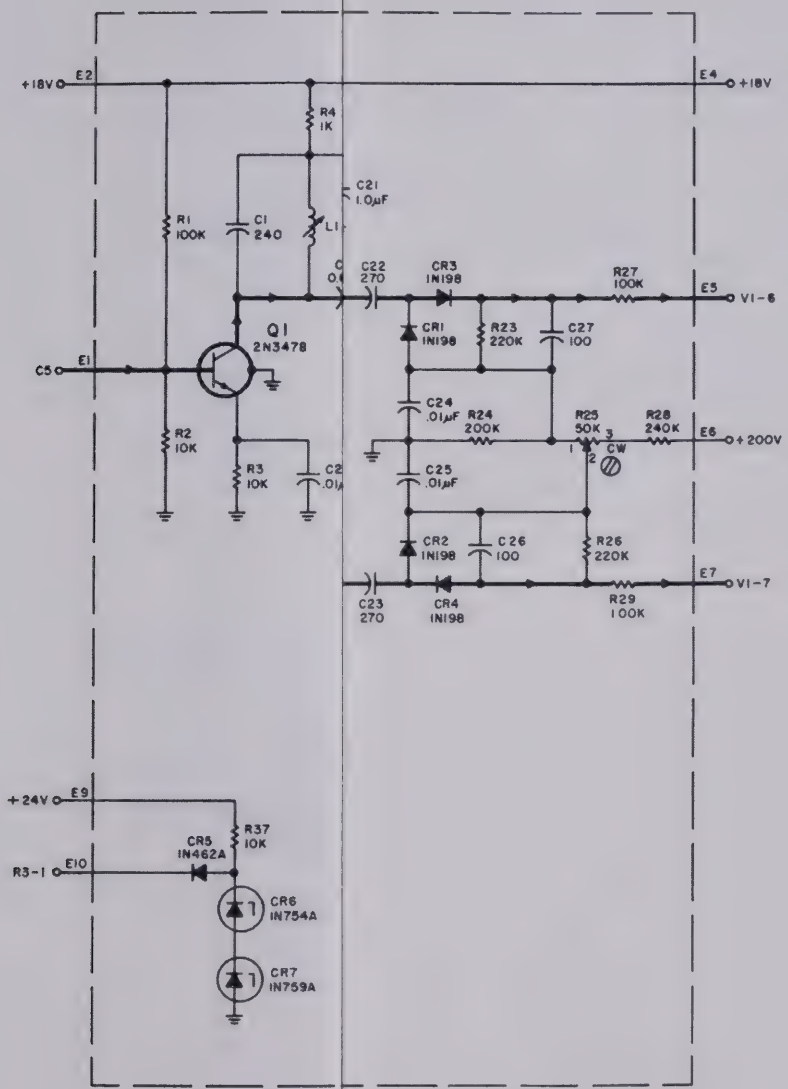
NOTES

1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN pf
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN PREFIX THE PART DESIGNATION WITH A1OSA1A1
3. HEAVY LINE INDICATES MAIN SIGNAL PATH

Figure 6-7. Type 13748 IF Amplifier Board No. 1, Schematic Diagram

Figure 6-8

DESIG PREFIX A4A1A2

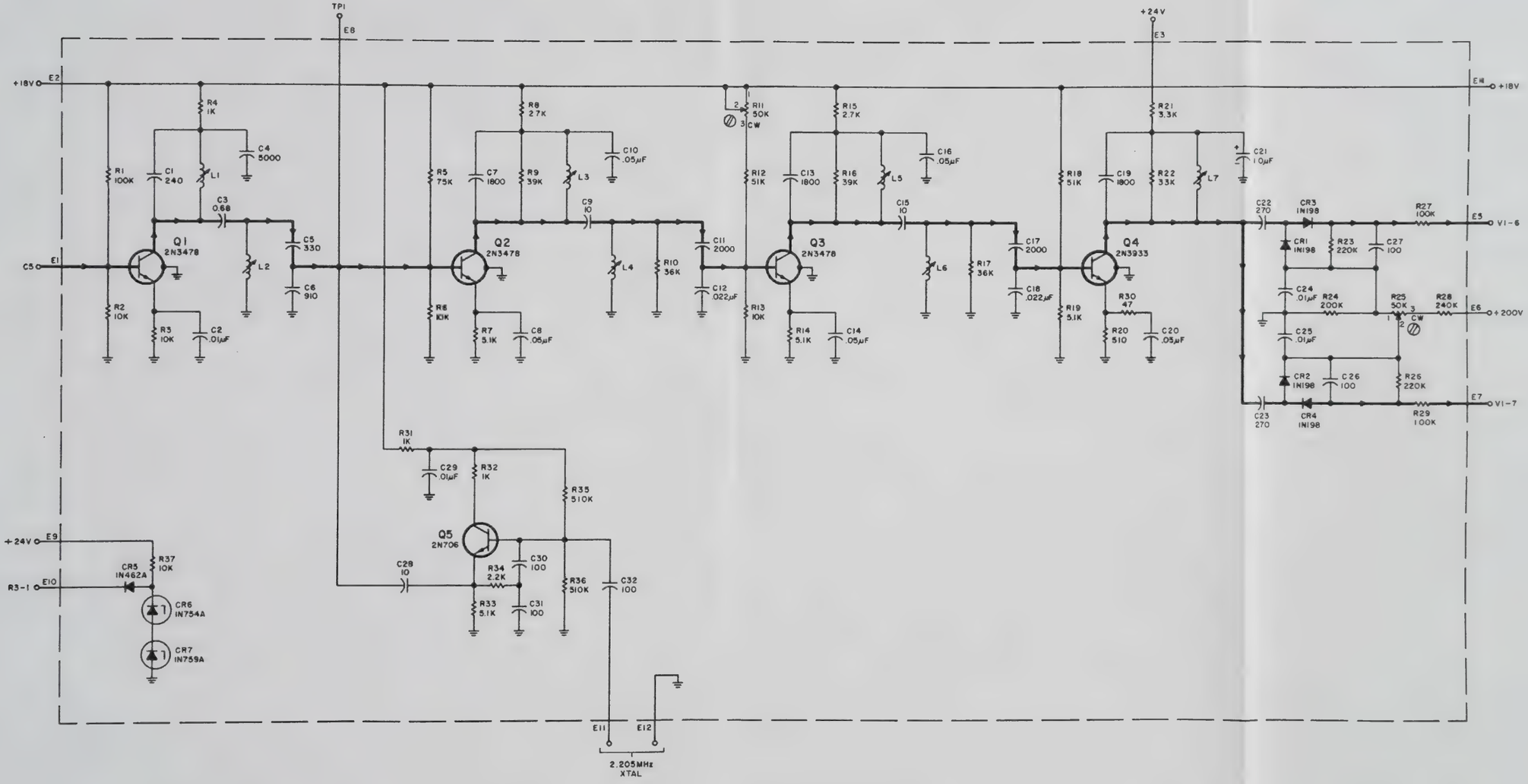


NOTES:

1. UNLESS OTHERWISE
   A. RESISTANCE IS ME
   B. CAPACITANCE IS ME
2. HEAVY LINE INDICATE
3. THE FOLLOWING NOT
   CW INDICATES CLOC
   INDICATES SCR

Type 13750 IF Amplifier Board No. 2, Schematic Diagram

REF DESIG PREFIX A4A1A2



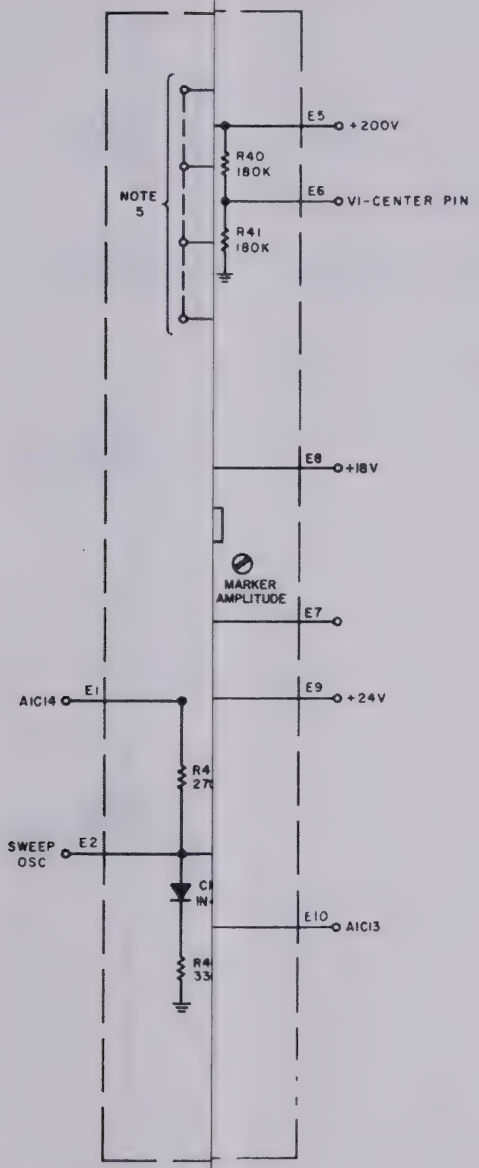
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   B. CAPACITANCE IS MEASURED IN pF.
2. HEAVY LINE INDICATES MAIN SIGNAL PATH.
3. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   CW INDICATES CLOCKWISE ROTATION OF CONTROL KNOB.
   ⊘ INDICATES SCREWDRIVER ADJUSTMENT

Figure 6-8. Type 13750 IF Amplifier Board No. 2, Schematic Diagram

Figure 6-9

A4A2



NOTES

1 UNLESS OTHERWISE S
a) RESISTANCE IS ME
b) CAPACITANCE IS N

2 PARTIAL REFERENCE
PREFIX THE PART DE

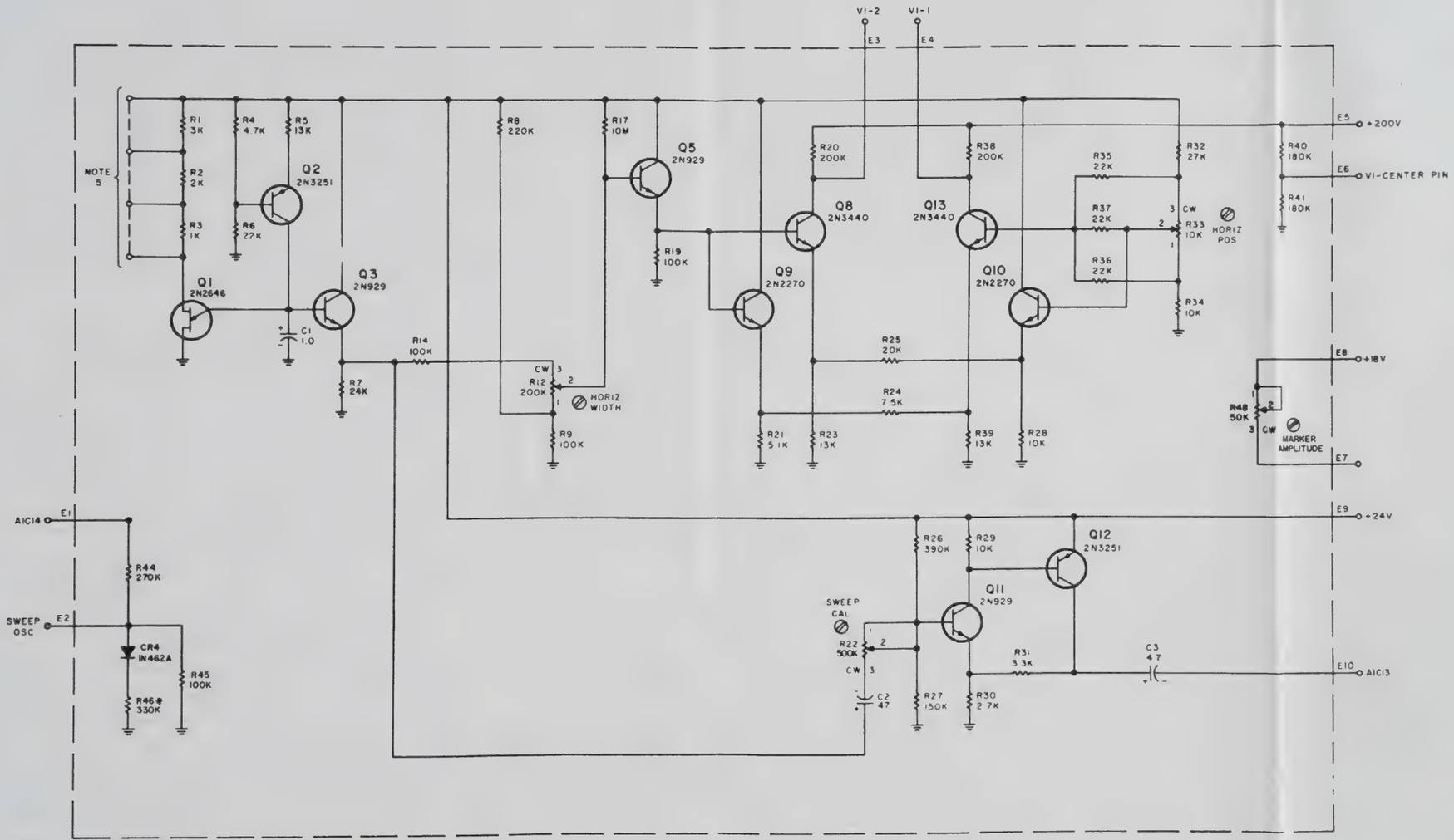
3 * INDICATES NOMINAL

4 THE FOLLOWING NOTA
POTENTIOMETERS
CW INDICATES CLOCK
INDICATES SCRE

5 CONNECTIONS MAY BE
AT FACTORY TO ADJU

29 Sweep Generator and
er, Schematic Diagram

REF DESIG PREFIX A4A2

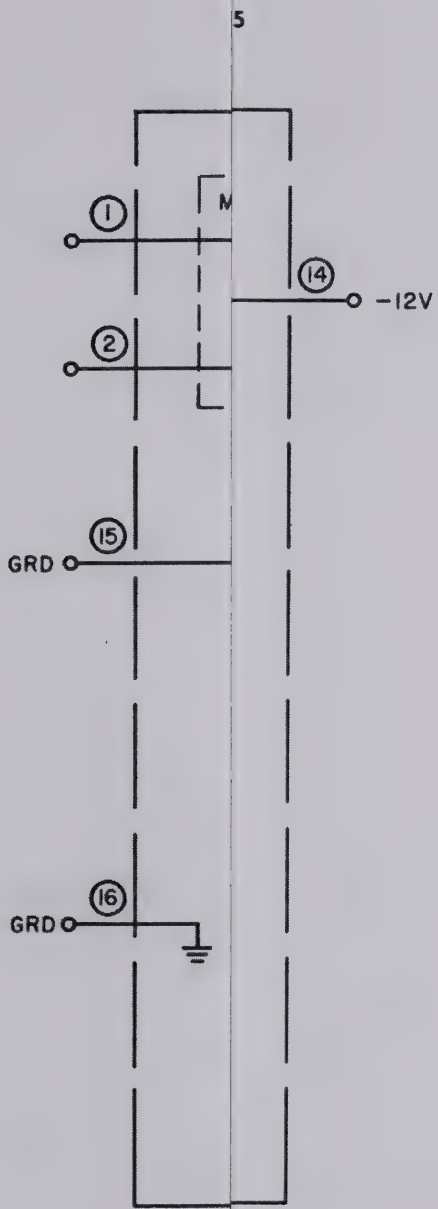


NOTES

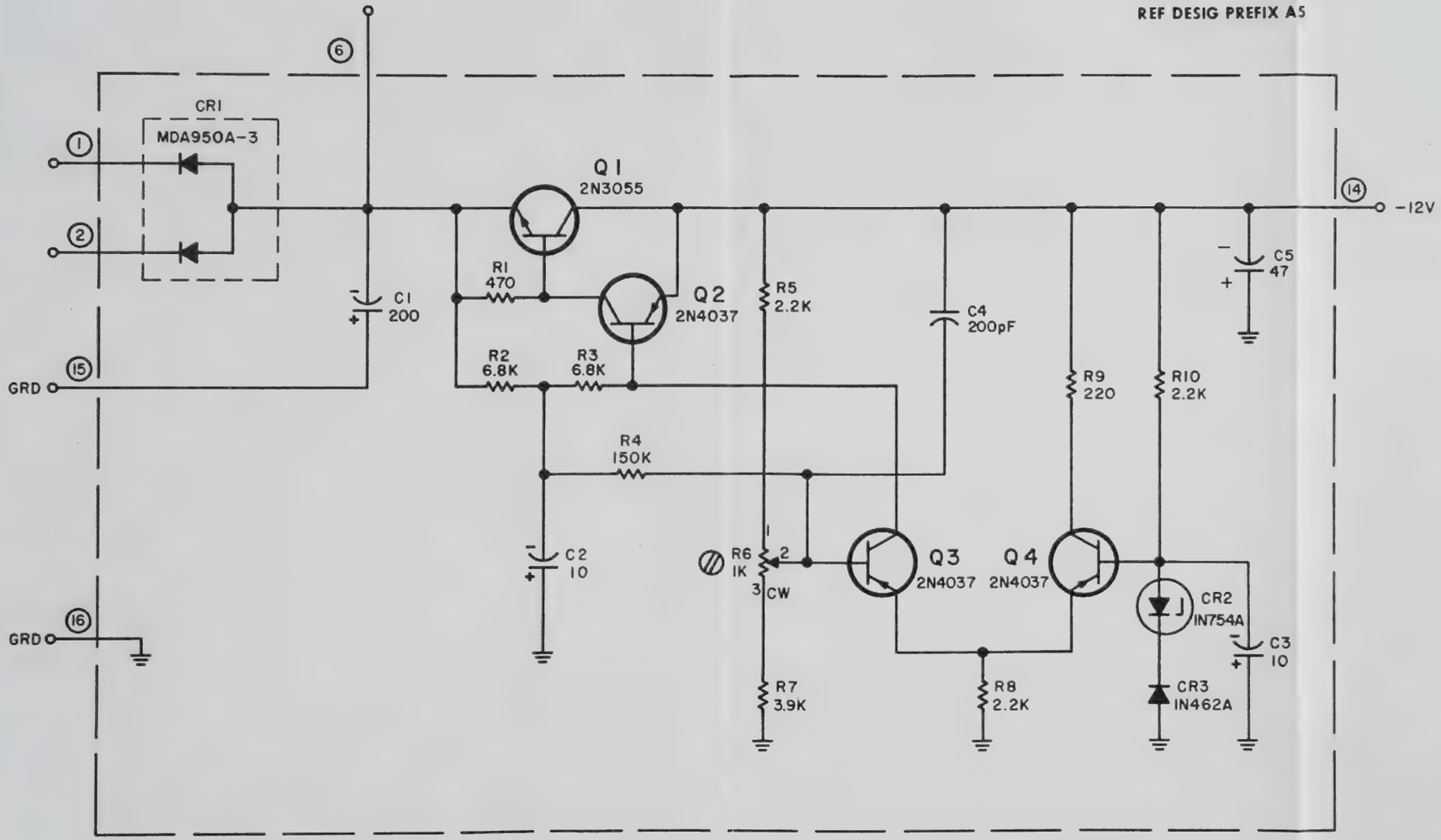
1 UNLESS OTHERWISE SPECIFIED
  a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
  b) CAPACITANCE IS MEASURED IN μf
2 PARTIAL REFERENCE DESIGNATIONS ARE SHOWN PREFIX THE PART DESIGNATION WITH A1O5A2
3 * INDICATES NOMINAL VALUE, FINAL VALUE FACTORY SELECTED
4 THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS
  CW INDICATES CLOCKWISE ROTATION
  ⊘ INDICATES SCREWDRIVER ADJUSTMENT
5 CONNECTIONS MAY BE MADE ACROSS R1/R2/R3 AT FACTORY TO ADJUST DC LEVEL

Figure 6-9. Type 8229 Sweep Generator and Horizontal Amplifier, Schematic Diagram

Figure 6-10



ed Power Supply,



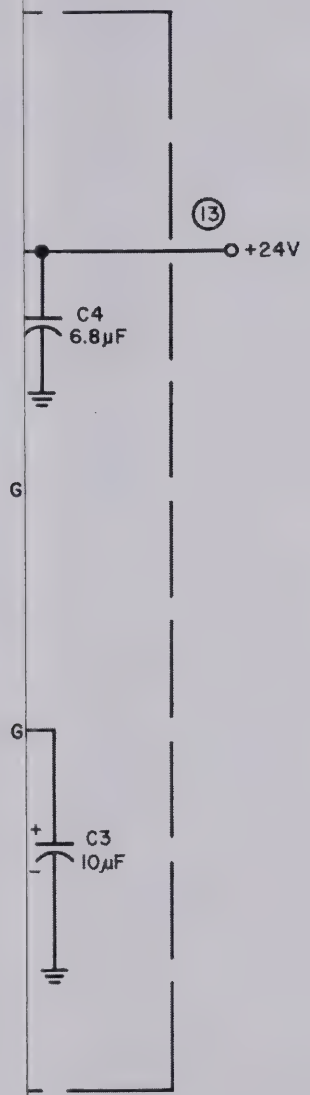
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   B. CAPACITANCE IS MEASURED IN μF
2. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   CW INDICATES CLOCKWISE ROTATION
   ⊘ INDICATES SCREWDRIVER ADJUSTMENT.
3. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

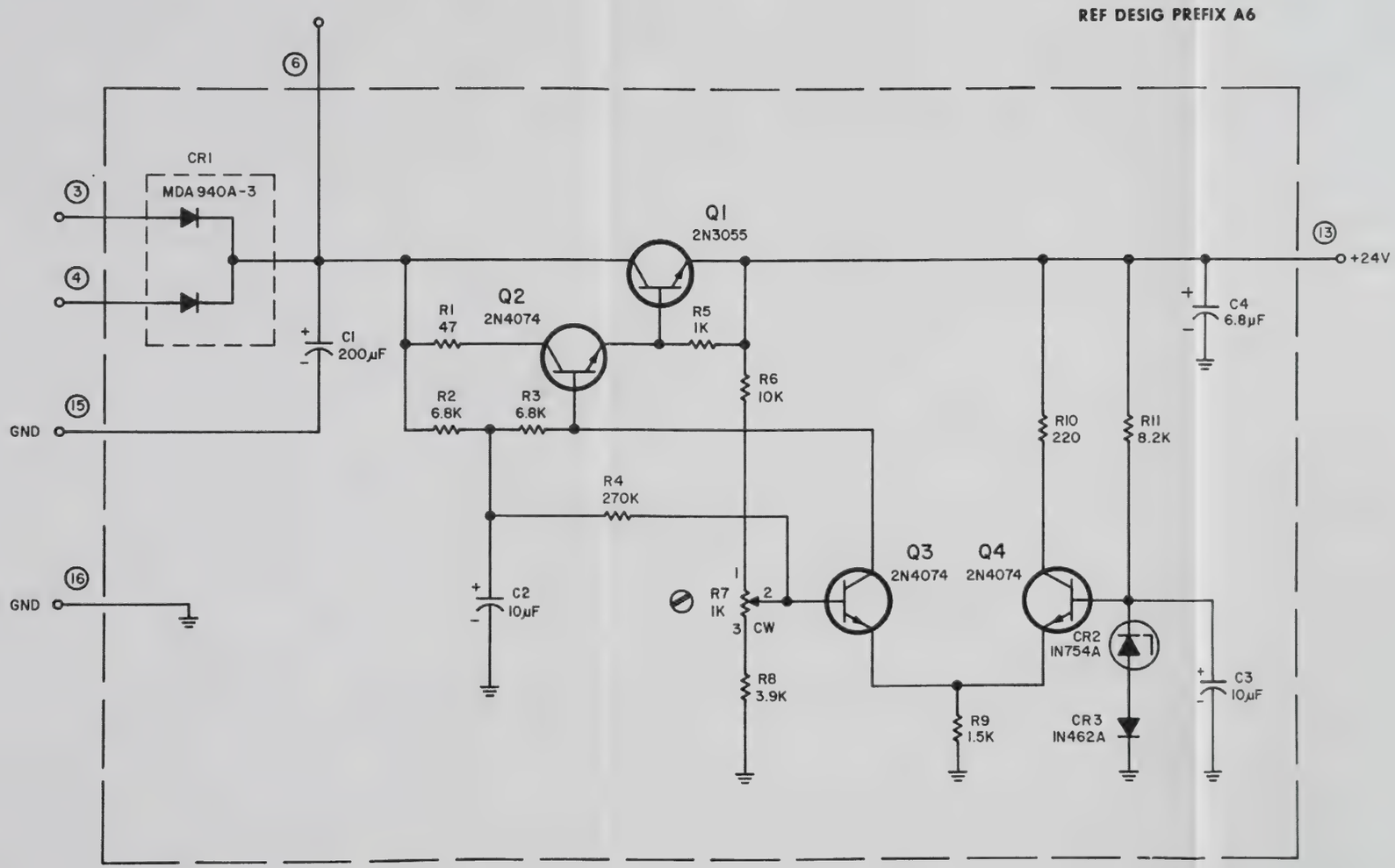
Figure 6-10. Type 76118A -12V Regulated Power Supply, Schematic Diagram

Figure 6-11

EFIX A6



Regulated Power Supply,
gram



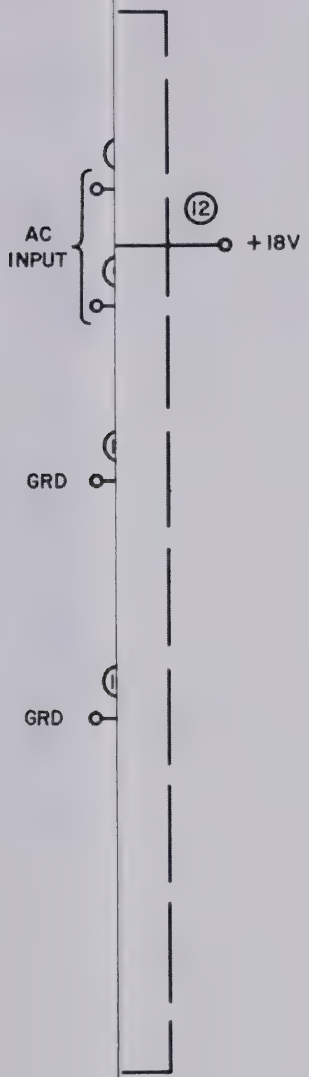
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE IS MEASURED OHMS, ±5%, 1/4 W
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS
3. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   CW INDICATES CLOCKWISE ROTATION
   ⊘ INDICATES SCREWDRIVER ADJUSTMENT

Figure 6-11. Type 76121A +24V Regulated Power Supply, Schematic Diagram

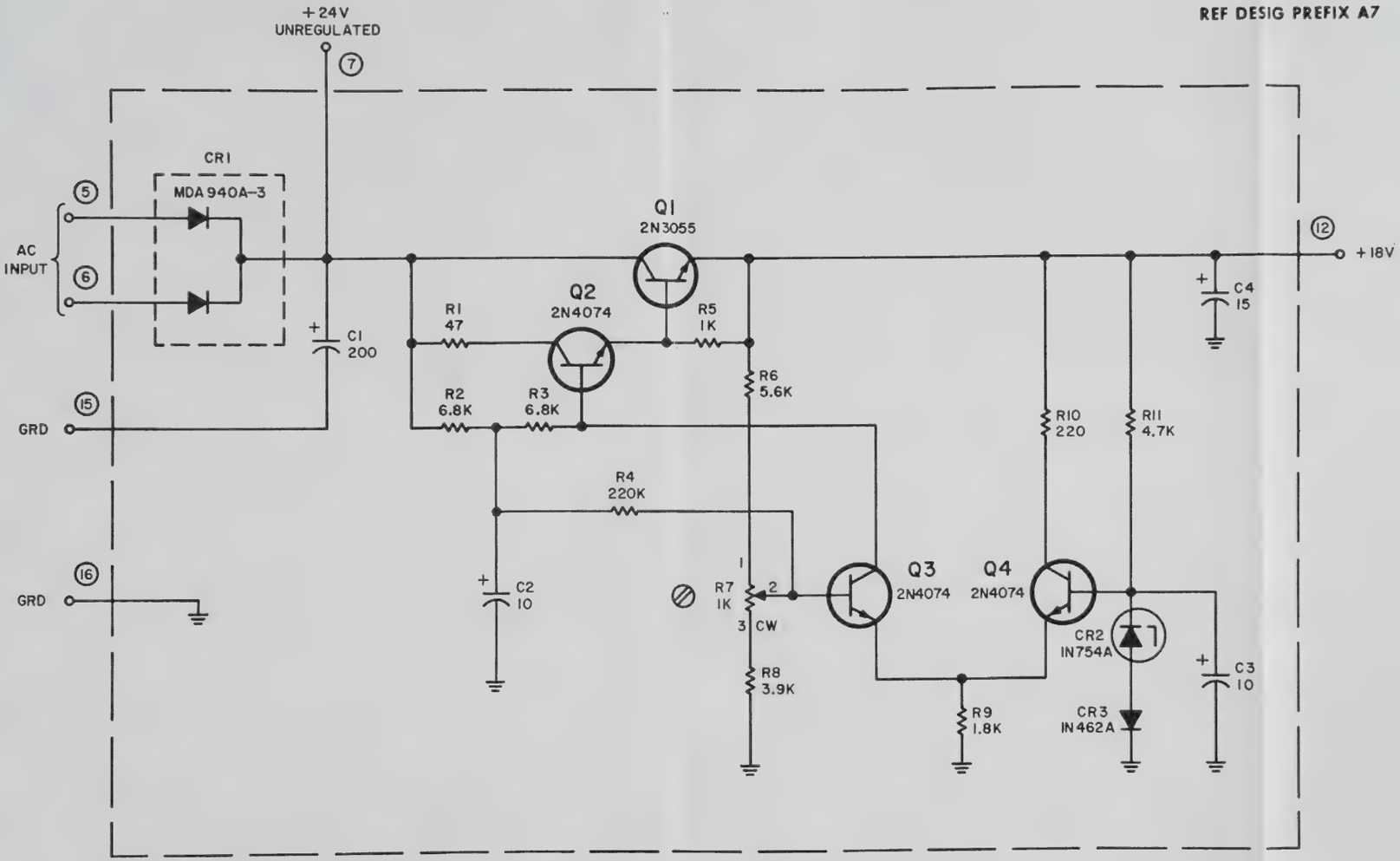
Figure 6-12

IG PREFIX A7



d Power Supply,

REF DESIG PREFIX A7

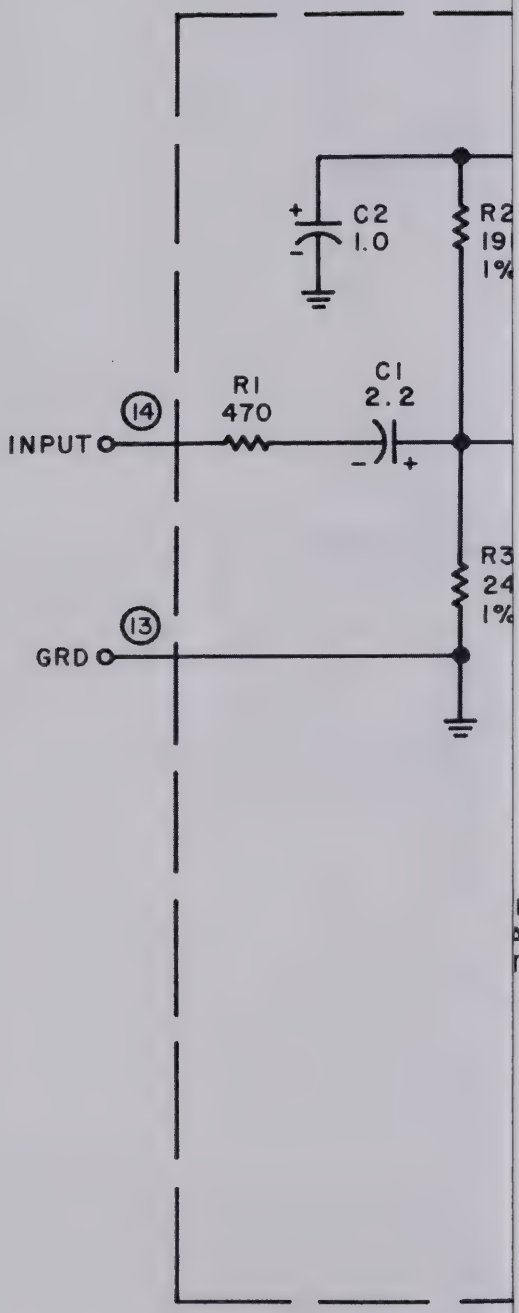


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   ⊘ INDICATES SCREWDRIVER ADJUSTMENT
   CW INDICATES CLOCKWISE ROTATION
4. PARTIAL REFERENCE DESIGNATIONS SHOWN. PREFIX PART DESIGNATION WITH A4.

Figure 6-12. Type 76123 +18V Regulated Power Supply, Schematic Diagram

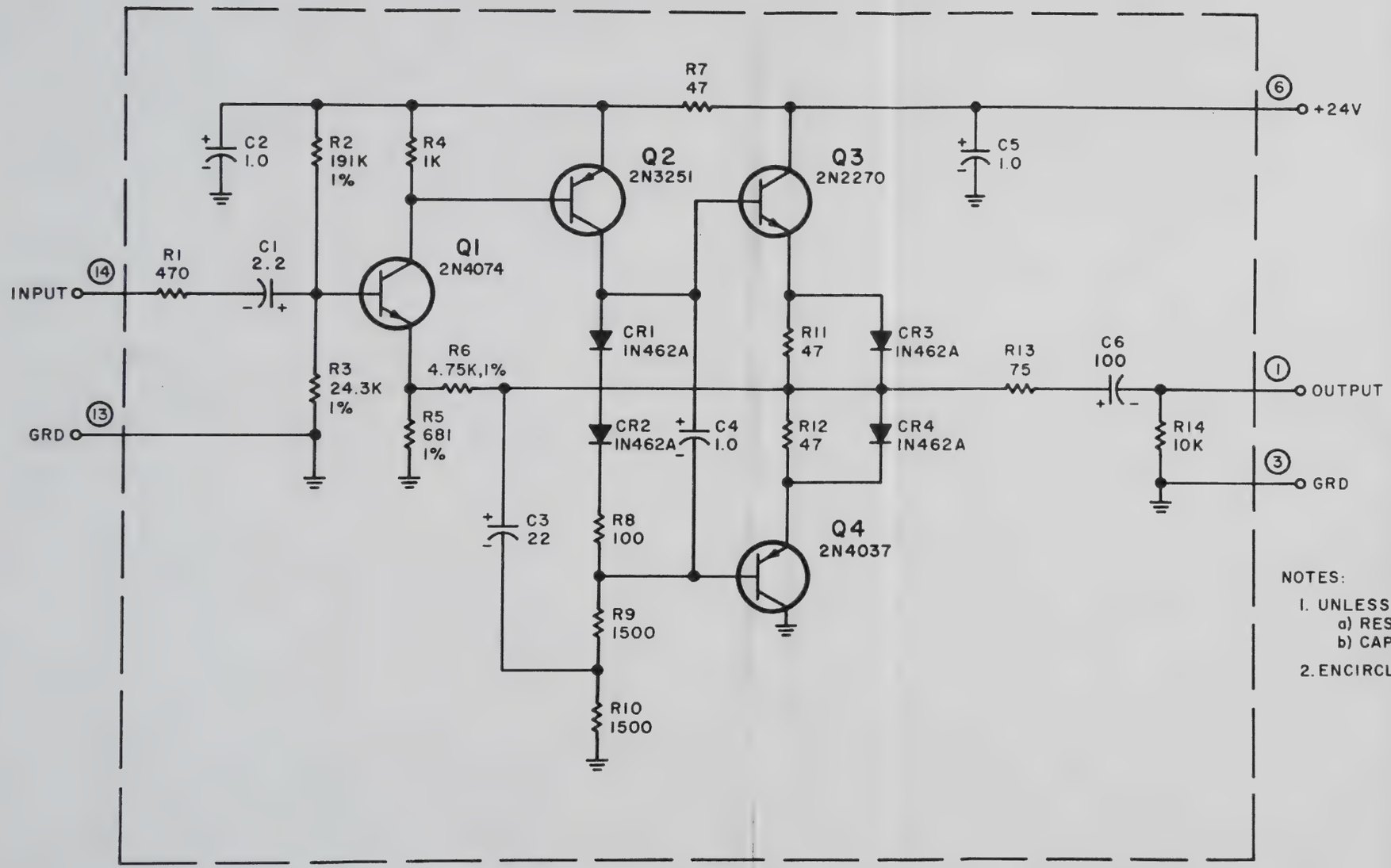
REF DESIG PREFIX A8



HERWISE SPECIFIED:
ANCE IS MEASURED IN OHMS, ±5%, 1/4W.
TANCE IS MEASURED IN μf.
NUMBERS ARE MODULE PIN NUMBERS.

Figure 6-13. Type 7338 Video Amplifier, Schematic Diagram

REF DESIG PREFIX A8



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μf.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

Figure 6-13. Type 7338 Video Amplifier, Schematic Diagram

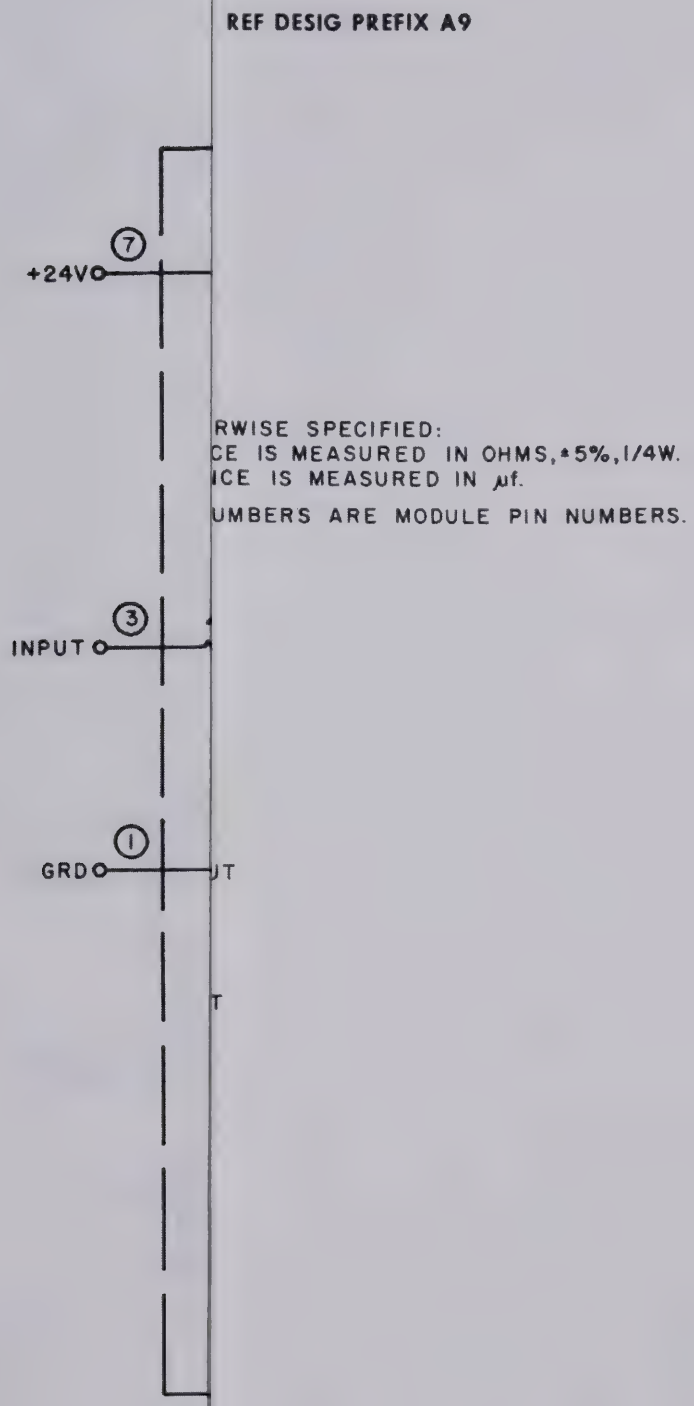
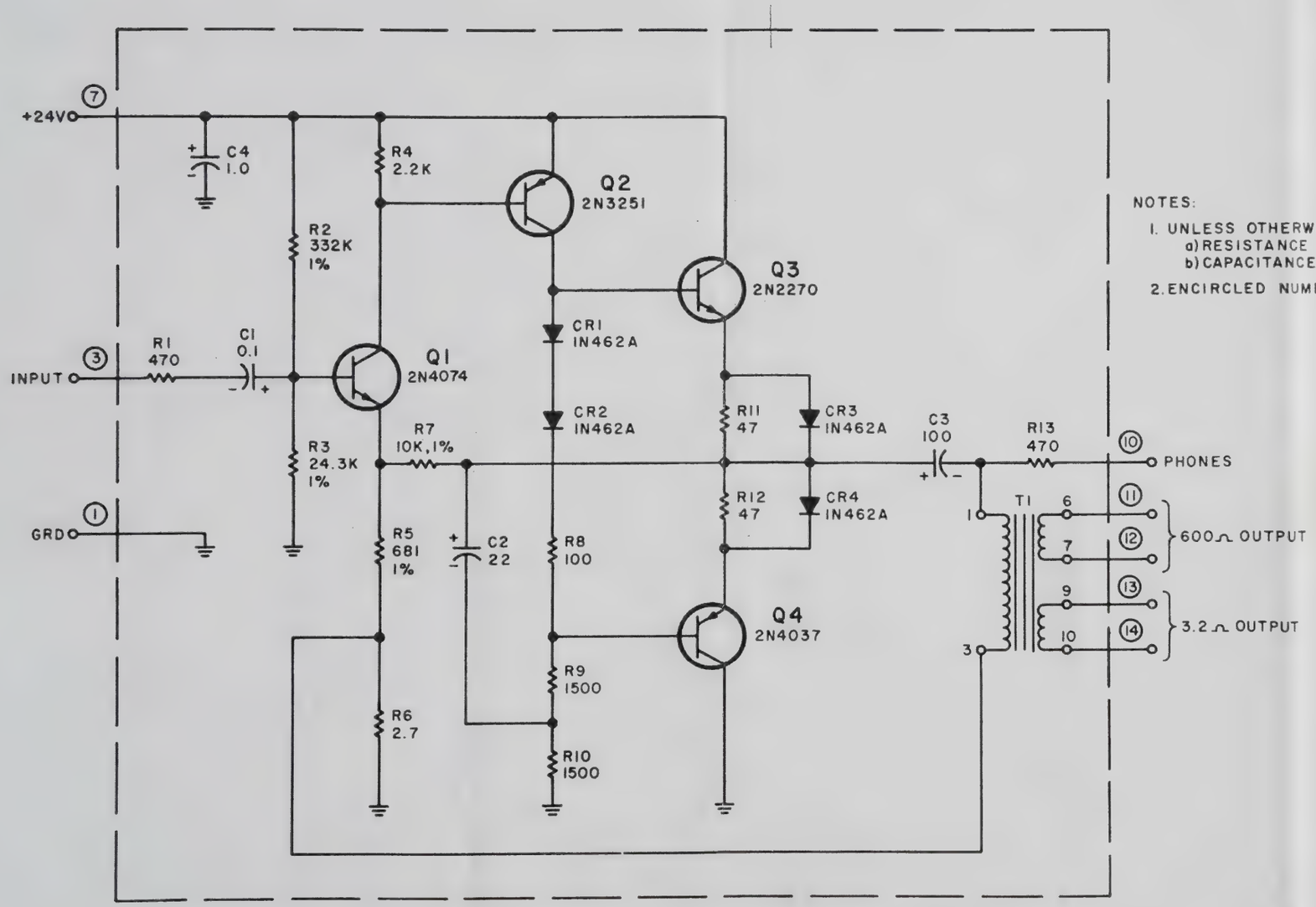


Figure 6-14. Type 7424 Audio Amplifier, Schematic Diagram

REF DESIG PREFIX A9

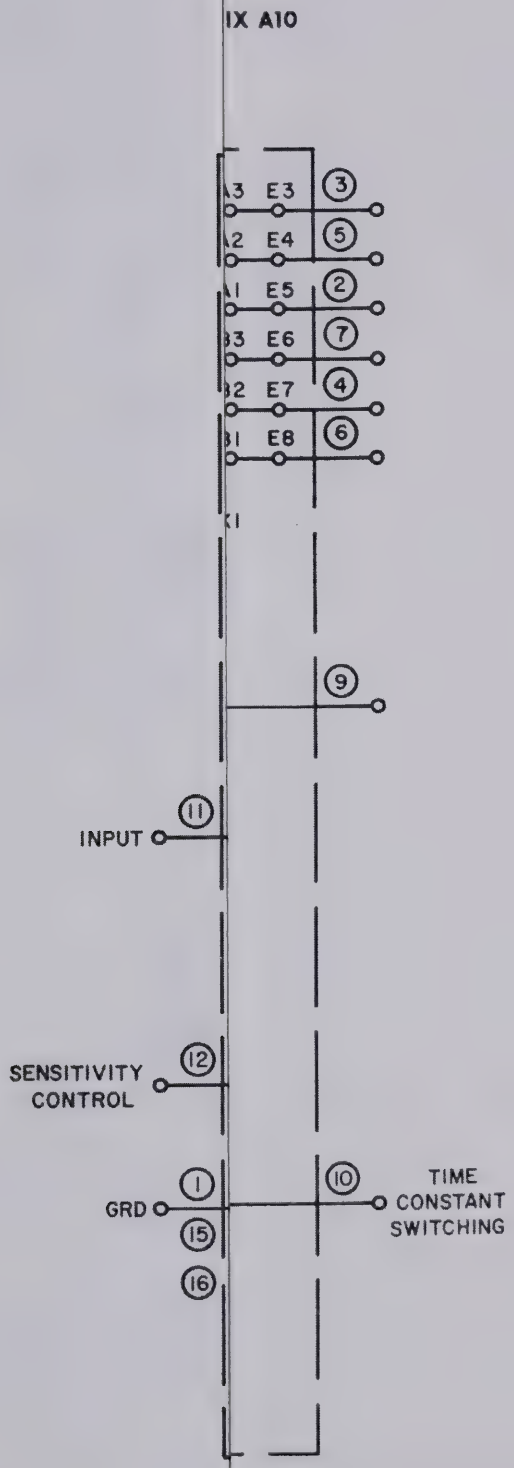


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μf.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

Figure 6-14. Type 7424 Audio Amplifier, Schematic Diagram

Figure 6-15



9 Carrier Operated Relay,
tic Diagram

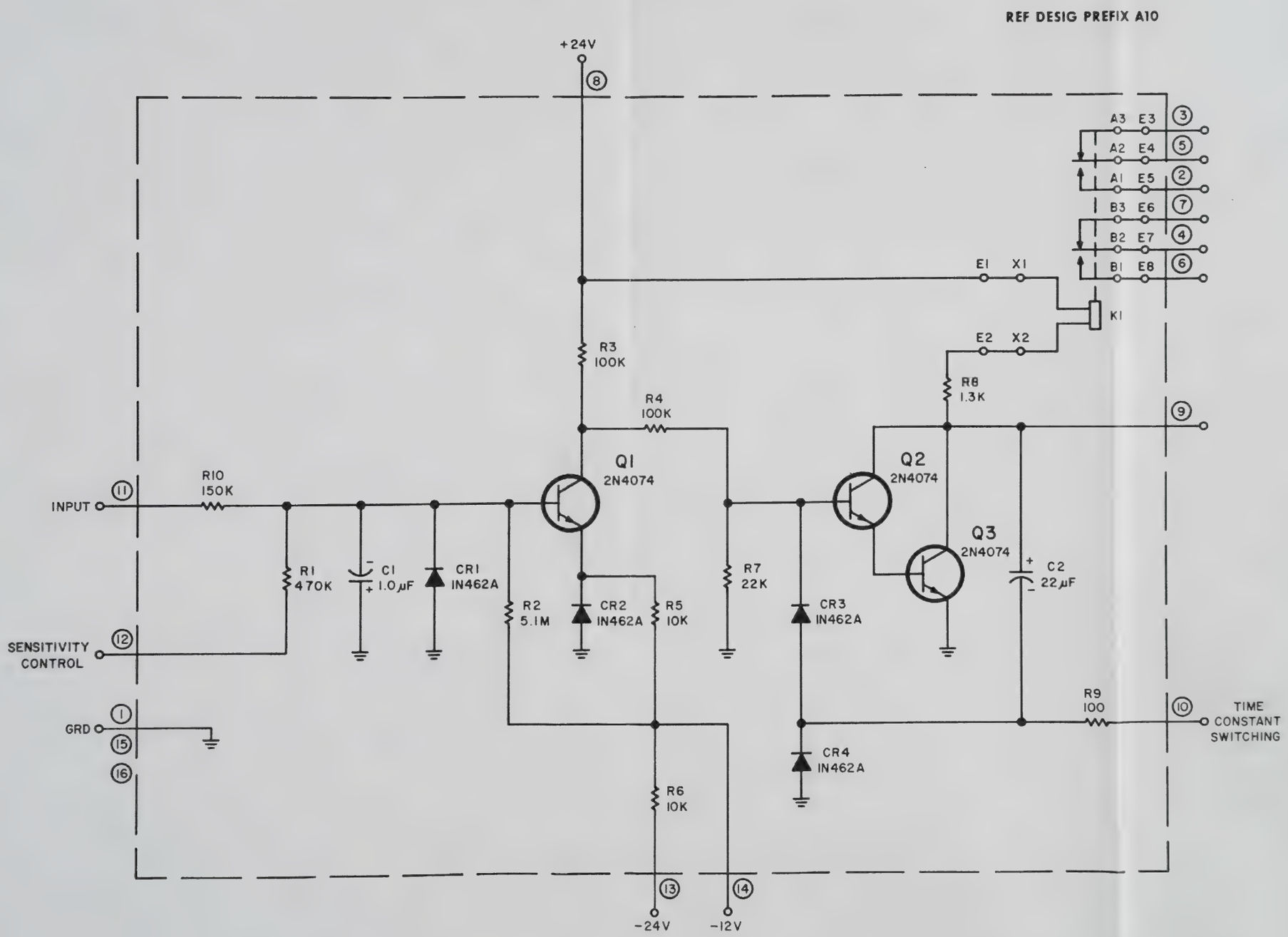


Figure 6-15. Type 7509 Carrier Operated Relay, Schematic Diagram

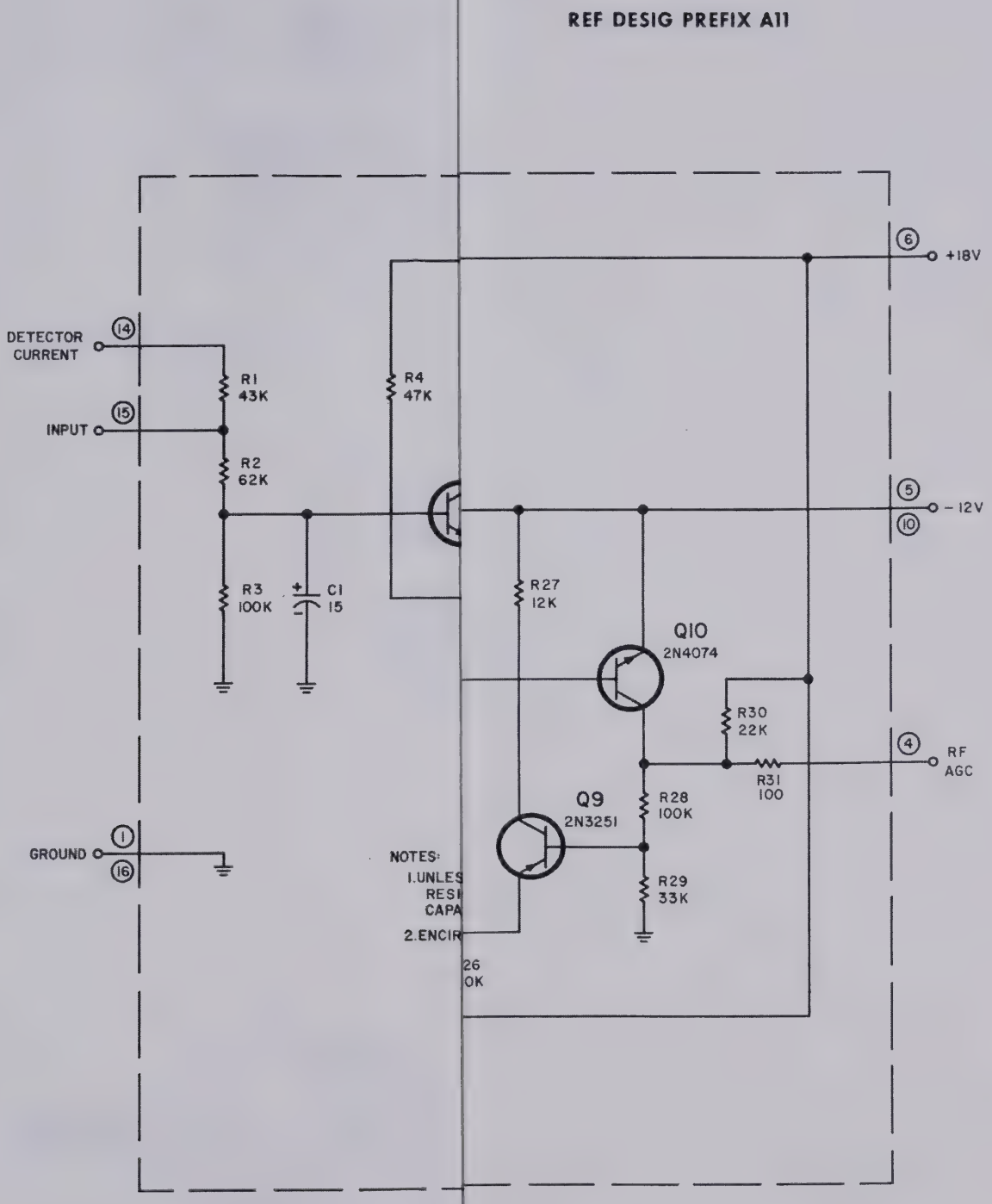


Figure 6-16. Type 79316 AGC Amplifier, Schematic Diagram

REF DESIG PREFIX A11

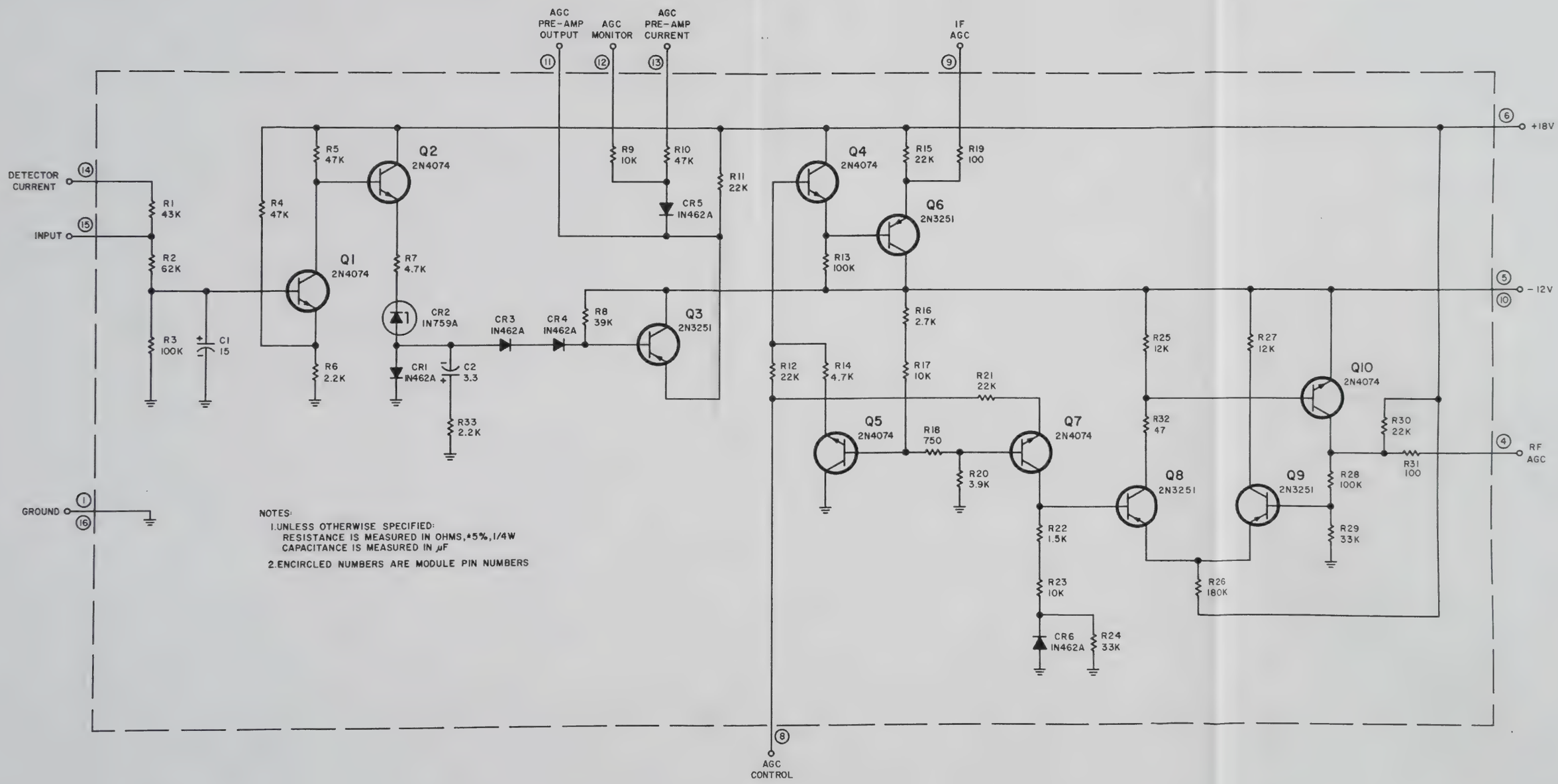


Figure 6-16. Type 79316 AGC Amplifier, Schematic Diagram

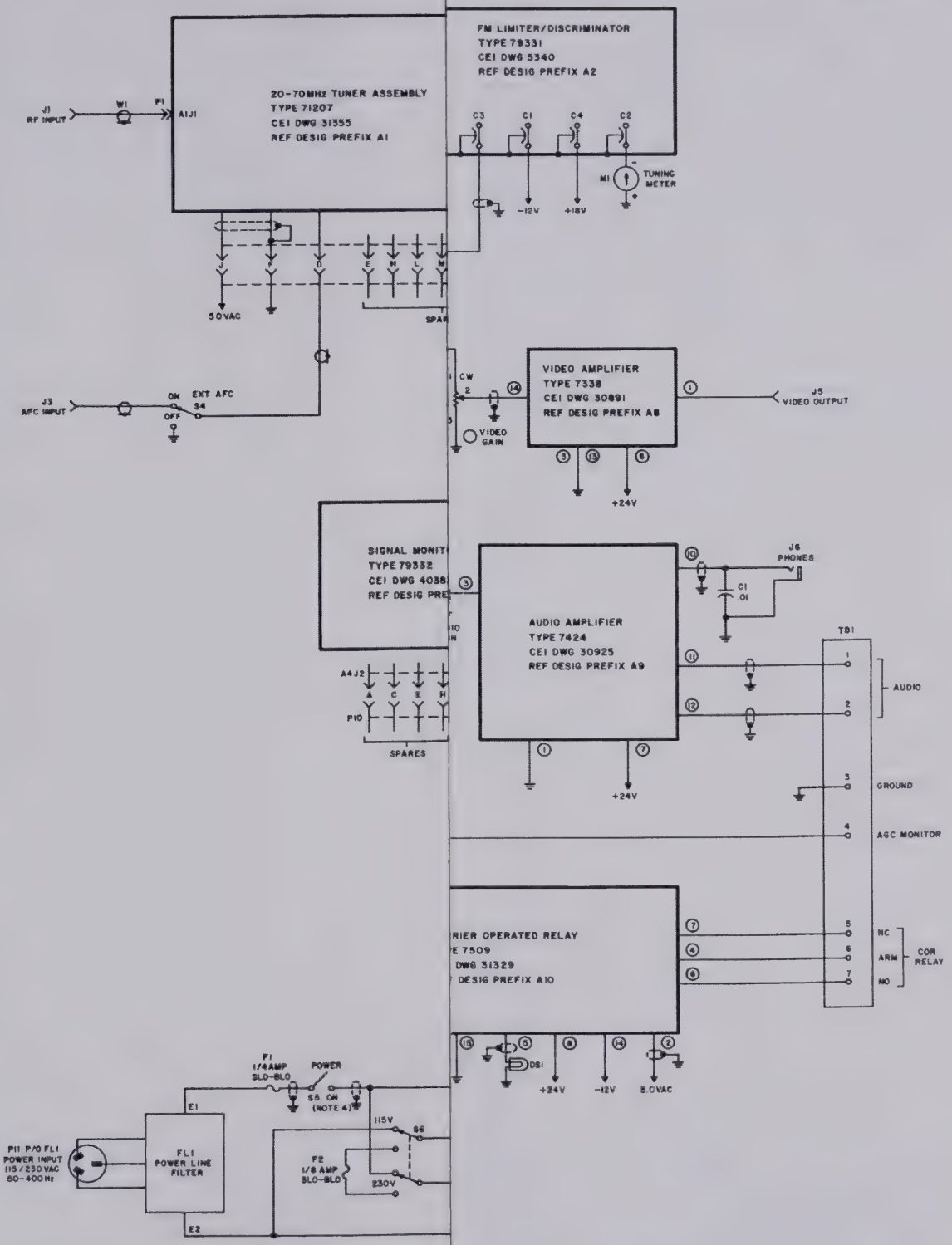


Figure 6-17. Type 521A Receiver, Main Chassis Schematic Diagram

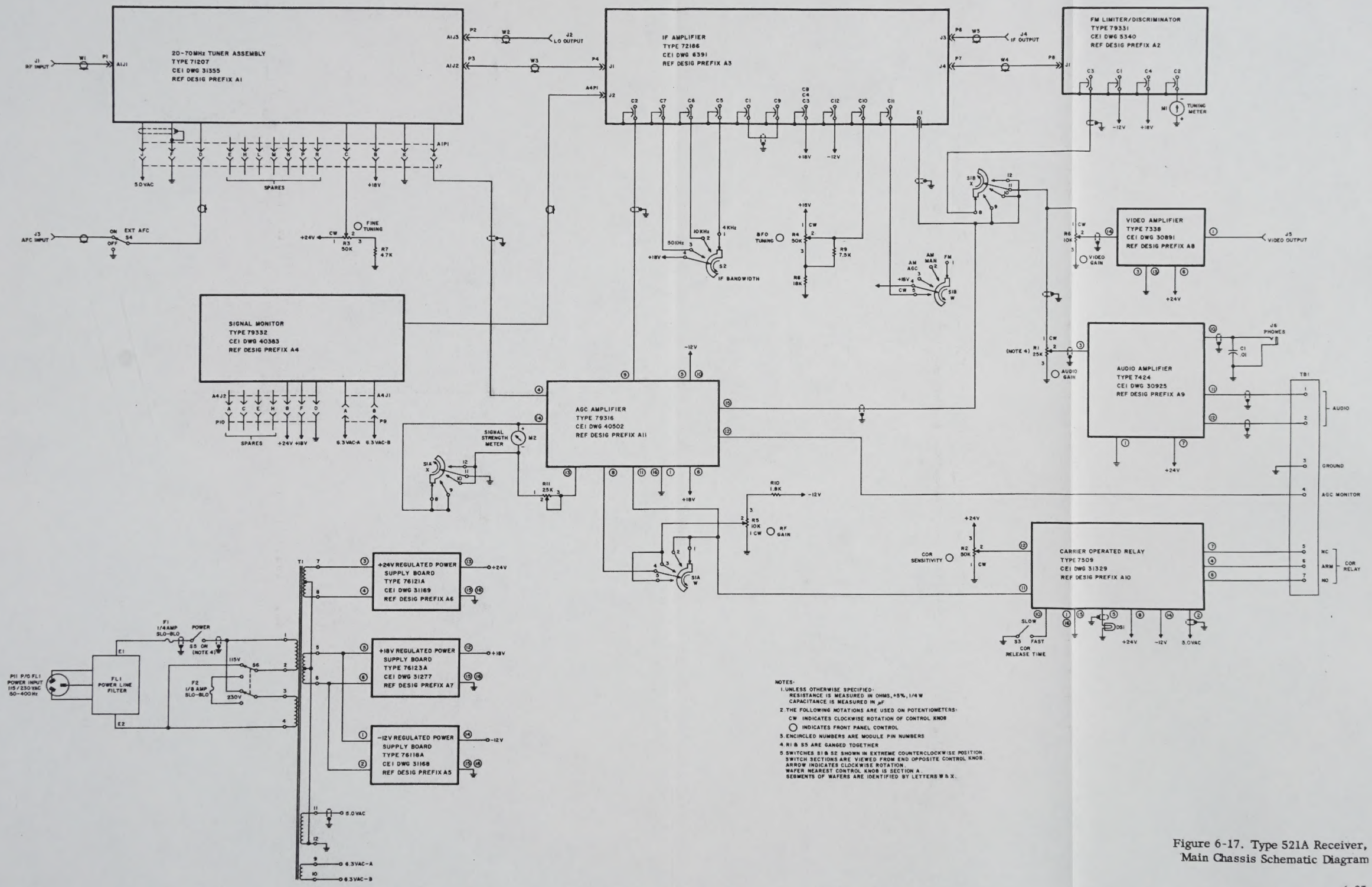


Figure 6-17. Type 521A Receiver, Main Chassis Schematic Diagram